G. FORMAT

Section . 03 - Schematics

Contains simplified schematics designed specifically to provide in-flight reference to system operation. The same basic style, showing primary system flow from left to right or top to bottom, is employed for all schematics. Unless mentioned in specific producures, electrical power sources are normally not specifically labelled. Pictorial controls and indicators are shown at the point in the schematic where they attach; they are not necessarily oriented to each other or to the aircraft instrument panels. A Code/Condition block states the condition shown in the schematic; most schematics are designed to show the system in it's normal configuration with electrical power supplied and switches or controls in their usual position.

Section . 04 - Supplemental Information

Provides any additional information necessary to complete the operational picture of the system. May supplement an existing schematic or, in the case of small systems, summarize operation of the entire system.

Additional Sections

In some chapters additional sections are used to show information which does not fit the above categories. Titles of these sections are descriptive of their contents.

Chapter 12 is utilized for miscellaneous information of an operational nature. Instructions for use of the aircraft log book or requirements when operating a test flight are representative items found in this chapter.

Chapter 15 contains the Inoperative Equipment and Missing Parts Lists plus the normal en route operational performance charts together with instructions for their use. Performance capability curves for engine out configurations are also provided.

H. TABLE OF CONTENTS

I. GRAPHIC STANDARDS AND SYMBOLS

Graphic standards for system schematics in Flight Handbooks have been established. These standards are being used as new material is provided or as major changes to schematics are made.

The primary flow of any schematic is shown by the widest solid line. If more than one primary system is shown, such as a left and right system, coded patterns of the same width are used.

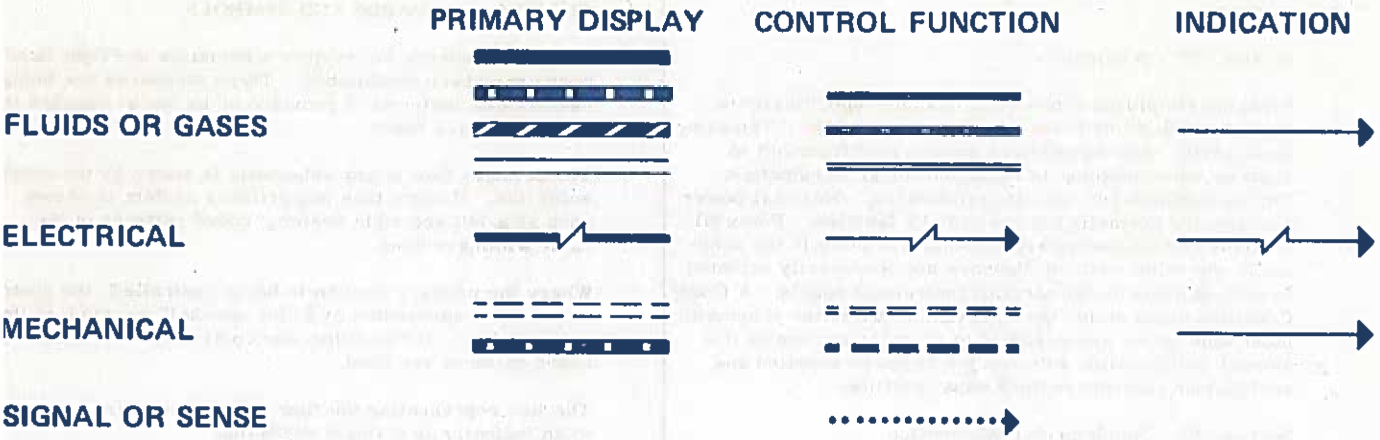
Where the primary system is being controlled, the control function is represented by a line one-half the width of the primary line. If more than one control system is shown, coded patterns are used.

The line representing the flow or connection from a system to an indicator is a single width line.

To differentiate between electrical, mechanical and fluid lines representative lines are used.

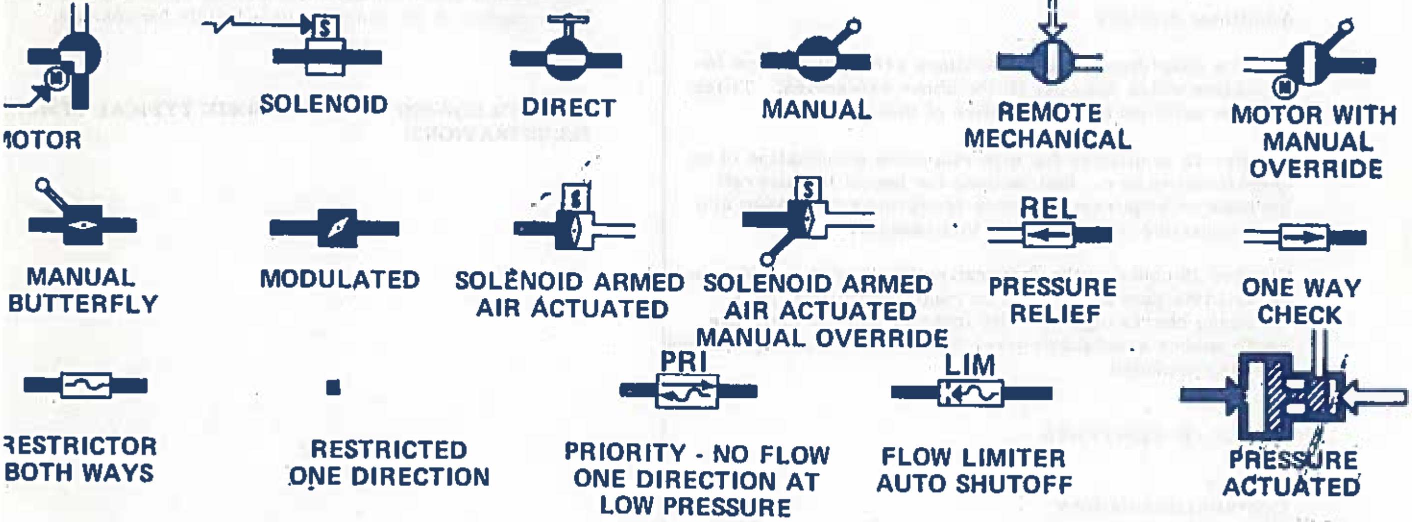
Standard symbols for system units are used where possible. The symbol also indicates the method used to acutate as: M for motor, S for solenoid or a handle for manual.

(SEE FOLLOWING PAGE FOR SOME TYPICAL SYMBOL ILLUSTRATIONS)

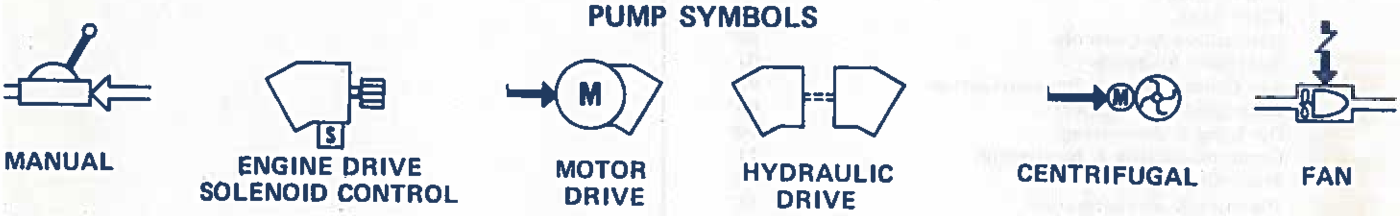


* The electrical symbol is not used where electrical flow is self evident such as a line originating at a circuit breaker.

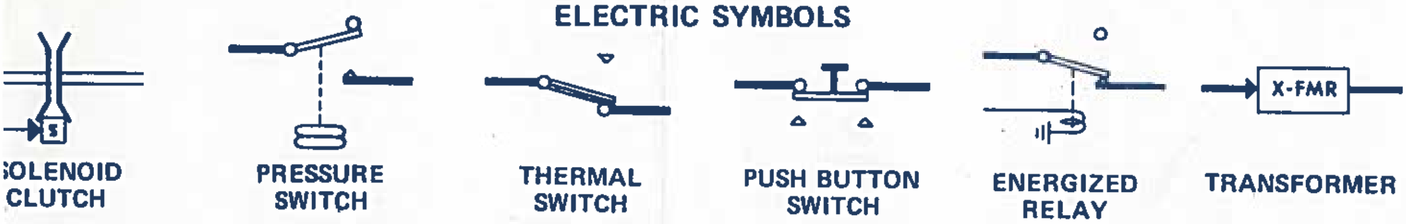
VALVE SYMBOLS



PUMP SYMBOLS



ELECTRIC SYMBOLS



e "▬" point of a switch indicates either it's momentary or relay energized position.

* * *

TRANS WORLD AIRLINES
CONVAIR 880
FLIGHT HANDBOOK

TRANSMITTAL RECORD PAGE

NUMBER	DATE CHANGED	INITIALS	NUMBER	DATE CHANGED	INITIALS	NUMBER	DATE CHANGED	INITIALS
106			145			184	4-25-71	WJM
107			146			185	8-19-71	WJM
108			147			186	8-19-71	WJM
109			148			187	9-27-71	WJM
110			149	12-3-68	W.J.M.	188	9-27-71	WJM
111			150	12-30-68	W.J.M.	189	11/1/71	WJ
112			151	1-11-69	W.J.M.	190	12/6/71	WJM
113			152	1-25-69	W.J.M.	191	1/20/72	WJM
114			153	3-31-69	W.J.M.	192	2/5/72	WJM
115			154	3/-15-69	W.J.M.	193	3/18/72	WJM
116			155	5-23-69	W.J.M.	194	6/13/72	WJM
117			156	5-9-69	W.J.M.	195	7/27/72	WJM
118			157	5-31-69	W.J.M.	196	10/13/72	[illegible]
119			158	6-29-69	W.J.M.	197	10/11/72	WJM
120			159	7-7-69	W.J.M.	198	11/9/72	WJM
121			160	8-15-69	W.J.M.	199	1/18/73	W
122			161	8-15-69	W.J.M.	200	3/15/73	WJM
123			162	8-28-69	W.J.M.	201	4/16/73	WJM
124			163	10-23-69	WJM	202	6/5/73	[illegible]
125			164	11-4-69	W.J.M.	203	6/5/73	WJM
126			165	12-3-69	WJM	204	9/5/73	WJM
127			166	1-9-70	W.J.M.	205	1/4/74	WJM
128			167	2-26-70	WJM	206	3/14/74	WJM
129			168	4-7-70	WJM	207	4/25/74	WJM
130			169	5-6-70	WJM	208		
131			170	5-21-70	W.J.M.	209	6/5/74	WJM
132			171	6-19-70	W.J.M.	210		
133			172	8-6-70	W.J.M.	211		
134			173	8-6-70	WJM.	212		
135			174	8-19-70	W	213		
136			175	9-5-70	WJM	214		
137			176	10-3-70	W	215		
138			177	10-3-70	W	216		
139			178	3-1-71	W	217		
140			179	11-15-70	W	218		
141			180	11-15-70	W	219		
142			181	1-25-70	WJM	220		
143			182	2-15-71	WJM	221		
144			183	3-13-71	WJM	222		

:HABETICAL INDEX

* * *

GENERAL

Observance of the limitations contained in section 1 of the FAA Approved Airplane Flight Manual is required by law.

The contents of this chapter are reproduced from section 1 of the FAA Approved Airplane Flight Manual. Whenever there is a difference between the limitations contained in this chapter and those in the remaining chapters of this handbook, the most conservative limitation is to be observed.

TYPE OF AIRCRAFT OPERATION

This aircraft is certificated in the Transport Category under the appropriate portions of CAR 4b and SR-422B. The following operations are permitted when the required equipment is installed and operating:

1. Night
2. Instrument (IFR)
3. Icing Conditions

NOTE
Performance restrictions with tail de-icing system deleted are included in the Gross Weight section of chapter 15.

MAXIMUM OPERATING ALTITUDE

The maximum operating altitude for this aircraft is 41,000 feet.

FLIGHT CREW

A minimum flight crew consisting of pilot, co-pilot and flight engineer is required.

WEIGHT LIMITATIONS

This aircraft must be operated in accordance with the appro-
→priate Takeoff and Landing Gross Weight charts issued by TWA.

MAXIMUM STRUCTURAL AIRCRAFT WEIGHTS

Ramp Weight . . . . 185,000 Pounds.

Takeoff Weight . . . . . 184,500 Pounds.

Landing Weight . . . . . 155,000 Pounds.

Zero Fuel Weight . . . . 117,000 Pounds.

NOTE
All weight in excess of 117,000 pounds must consist of fuel and all weight in excess of 155,000 pounds must consist of jettisonable fuel.

TAKEOFF CLIMB, WEIGHT LIMITS

One engine inoperative climb takeoff; landing gear retracted.

1. The second segment climb is the only weight limiting take-
→ off climb. See Takeoff Gross Weight charts issued by TWA.
2. Aircraft configuration
   (a) Landing gear retracted.
   (b) Takeoff flap position (20°).
   (c) Any engine inoperative.
   (d) The remaining engines at takeoff power/thrust available at a height of 400 feet above the takeoff surface.
   (e) Speed = V_2.

DETERMINATION OF MAXIMUM ALLOWABLE TAKEOFF WEIGHTS

The maximum allowable takeoff gross weight can be determined
→by reference to the Takeoff Gross Weight Data charts issued by TWA.

LANDING AND APPROACH CLIMB WEIGHT LIMITS

When an approach climb limitation exists it is shown in the Landing Gross Weight charts in chapter 15 under the Critical Temperature column for the airport.

Landing climb restrictions do not apply, since the approach climb limit is more restrictive.

POWER PLANT LIMITATIONS

This aircraft is equipped with four General Electric CJ-805-3A turbojet engines. A thrust reverser mechanism and a noise suppressor assembly are installed on each engine.

OPERATING LIMITS

Starting EGT . . . . 660°C or 600°C for 25 secs.

Takeoff power:

RPM . . . . 103% @ 32°F & above decreasing to 97% @ -25°F.

EGT . . . . 650°C/15 seconds.

EPR . . . . See takeoff thrust setting charts in chapter 15.

Maximum continuous power:

EGT . . . . 560°C.

NOTE
TWA climb performance data is based on engine EPR. At these settings, if the EGT exceeds 560°C, the EPR must be reduced to maintain the maximum permissible temperature. Maintenance personnel should be notified so that corrective action can be initiated.

ENGINE PRESSURE RATIO

Aircraft takeoff is prohibited when EPR is below that shown on the Takeoff Thrust Setting chart in chapter 15.

FUEL TYPES

The engine may be operated on commercial aviation kerosene type fuels, JP-4, JP-5. No fuel control adjustment is required for these different fuels.

/ER PLANT LIMITATIONS (Cont'd.)

TYPES

engine is to be operated with Type I oils (conforming to eral Electric Specification D50TF1-S4 Class A) or Type II (conforming to General Electric Specification D50TF1-S4 ss B). Intermixing of oils by type or produced by different dors is not permitted.

GINE THRUST REVERSER LIMITATIONS

use of thrust reversers in flight is prohibited.

rust reversers can be operated at full reverse thrust (100% M) until a decrease in aircraft speed to 70 KTS IAS. Below KTS IAS, power setting must be reduced to approximately RPM. Thrust reverser use on landing roll-out should be sed after 30 seconds of continuous operation.

NOTE

Operation as noted above will prevent severe compressor stalls.

GINE ANTI-ICING SYSTEM LIMITATIONS

ine anti-icing may be operated continuously at any er setting when compressor inlet temperature is below °C. Do not operate engine anti-icing system when com- ssor inlet temperature is above +15°C.

NOTE

For ground checking, or when a malfunctioning anti-ice valve is suspected, the engine may be operated with a compressor inlet temperature above +15°C for 5 minutes at any power setting and for 20 minutes at idle power.

GINE AIR STARTERS

use of engine air starters in flight is prohibited.

GINE BLEED AIR LIMITS

avoid exceeding maximum allowable engine bleed air limits en anti-icing systems are operating, the following minimums ll be observed. (In all cases, engine anti-icing must be off inoperative engines.)

Four engine operation, a minimum RPM of 75% is required between 6000 and 22,500 feet.

Three engine operation, a minimum RPM of 76% is required between 6000 and 22,500 feet. A minimum RPM of 66% is required below 6000 feet.

Two engine operation, a minimum RPM of 78% is required between 10,000 and 22,500 feet. A minimum RPM of 76% is required below 10,000 feet. Do not operate between 90% and 94% RPM from 20,000 to 22,500 feet.

EL SYSTEM LIMITATIONS

is aircraft is equipped with four fuel tanks, each fuel tank nposed of a replenishment tank and a main tank. All fuel ks are integral with the wing structure.

FUEL LOADING LIMITATIONS

	U.S. GAL.	POUNDS
Maximum refuel quantity	10,776	75,432
Usable fuel quantity	10,684	74,788

NOTE

Note that the limiting value, regardless of fuel density, temperature or type, is 10,776 U.S. gallons or 75,432 pounds, whichever occurs first.

FUEL TEMPERATURE LIMITS

At engine fuel control inlet . . . 0°C Minimum (32°F)

NOTE

1. If the engine fuel control inlet temperature goes below 0°C, the temperature should be monitored. An increase in engine RPM to maintain minimum temperature may be required.

2. If the fuel control inlet temperature rises beyond the gauge capability, monitor the engine oil temperature and pressure. If the oil temperature or pressure exceeds limits, or engine surges, engine shutdown is advisable.

At fuel tank . . . -40°C to +54°C (-40°F to 129.2°F)

NOTE

At ambient temperatures below -1°C and altitude below 15,000 feet, engine RPM must be 70% or greater, or fuel control inlet temperature must be monitored and maintained above 0°C.

FUEL JETTISON LIMITATIONS

Fuel jettison must be in accordance with the requirements of the takeoff and landing fuel distribution limits and the In-Flight Asymmetric Fuel Distribution Limits chart in section 02.12.

BOOST AND TRANSFER PUMP LIMITATIONS

Both boost pumps inoperative in a tank:

Power reduction may be required for climb above 26,000 feet.

Inboard main or outboard tank transfer pump failure:

With less than 6000 pounds (total aircraft) or less than 1500 pounds in the tank having an inoperative transfer pump, crossfeed the affected tank with the adjacent tank on the same side. Do not shut off the affected tank.

FUEL CROSSFEED SYSTEM LIMITATION

Do not take off with crossfeed valves in the OPEN position.

FUEL SYSTEM LIMITATIONS (Cont'd.)

LANDING AND TAKEOFF FUEL DISTRIBUTION LIMITS

Structural Limitations:

The total inboard fuel shall not exceed the total outboard fuel by more than 3000 pounds unless the outboard tanks are full at the completion of fueling, in which case the maximum differential is that which exists at completion of refueling or 3000 pounds, whichever is greater. There are no structural limitations when outboard fuel exceeds the inboard fuel.

Balance Limitations:

The balance limitations for takeoff will be met when fuel is loaded as outlined in section 02. 09.

The balance limitations for landing will be met if fuel is used as outlined in section 02. 12. If deviation from this procedure is necessary, adhere to the structural limitations for takeoff and landing fuel distribution and no adverse CG problems will be incurred.

IN-FLIGHT ASYMMETRIC FUEL DISTRIBUTION LIMITS

In-flight asymmetric fuel distribution limits must not exceed 110, 000 foot pounds. (Refer to section 02. 12, In-Flight Asymmetric Fuel Distribution Limits.)

OIL SYSTEM LIMITATIONS

Start pressure . . . . A positive pressure indication which may peak to 200 PSI under extreme cold conditions (-40°C).

Oil Pressure, All Operations:

IDLE . . . . 12 to 40 PSI

TAKEOFF . . . . 40 to 80 PSI

All other conditions - See section 02. 75.

NOTE

Oil pressure can normally vary from 40 to 80 PSI in the cruise to takeoff power range. The normal operating oil pressure range should be approximately 40 PSI at low cruise RPM and approximately 70 PSI at takeoff RPM.

CAUTION

OPERATION OF THE ENGINE WITH ZERO OIL PRESSURE, INCLUDING WINDMILLING WHEN ENGINE IS SHUT DOWN IN FLIGHT, WILL RESULT IN ENGINE DAMAGE.

Oil Temperature . . . . 149°C Maximum

INSTRUMENT COLOR CODES

ENGINE INSTRUMENTS

Red radial line . . . Limit of operation

Yellow arc . . . . . . Caution range

Green arc . . . . . . Normal Operating range

NOTE

Minimum limits may also be marked by a red radial line. White radial lines are alignment check points.

FLIGHT INSTRUMENTS

Red radial line . . . Limit of operation

Yellow arc . . . . . . Caution range

Green arc . . . . . . Normal Operating range

NOTE

White radial lines are alignment check points.

FLAP AND STABILIZER TRIM INDICATORS

White arc or radial line indicates landing, takeoff and approved operating range.

AIRSPEED INSTRUMENTS

All instrument markings and placards in the aircraft are shown as indicated (IAS, M_I) values and are not corrected for the applicable instrument's error.

Airspeed indicator.
V_{mo}/M_{mo} - Indicated by maximum operating limit speed hand with black and red upper half and green and white lower half.

Machmeter.
M_{mo} = Red radial line with black crosshatch.

NOTE

The maximum operating limit speed shall not be deliberately exceeded in any regime of flight.

OPERATIONAL LIMITATIONS

TAKEOFF LIMITATIONS	Ranges
Altitude	-1000 feet to 8300 feet pressure altitude.
Runway slope	0 to ± 2%.
Tailwind component . .	0 to 10 knots.
Temperature	See chart, section 01. 07.

LANDING LIMITATIONS

Altitude	-1000 feet to 8300 feet pressure altitude
Runway slope	0 to ± 2%.
Tailwind component . .	0 to 10 knots.
Temperature	See chart, section 01. 07

EN ROUTE LIMITATIONS

Altitude.	0 to 41, 000 feet pressure altitude.
Temperature	See chart, section 01. 07.

NOTE

Aircraft operational data, based on various configurations of weight, temperature and field conditions within the above maximum aircraft limitations is included in section 01. 07.

TICAL CROSSWIND LIMITATIONS

maximum limiting crosswind value has not been deter-
ied. The maximum direct crosswind component so far
ted is 29 KTS. This is not a limiting value but represents
maximum value available at the time of the certification
ts.

en determining the effective takeoff and landing runway
gths in a crosswind the full headwind component can be used
vided the corresponding crosswind component does not
eed 29 KTS.

ISPEED LIMITATIONS

section 02.75.

IDING GEAR DOOR OPERATION LIMITATIONS

he landing gear door unlocked warning light illuminates
ing gear retracted flight operations, the airspeed must be
luced to 320 KTS IAS or Mach .83.

GHT LOAD ACCELERATION LIMITATIONS

ps retracted:

At all speeds up to V_{mo}/M_{mo} . . . . -1.0g to + 2.5g
At all speeds in excess of V_{mo}/M_{mo} . . . 0.0g to + 2.5g

ps extended:

At all speeds up to V_{fe} . . . . 0.0g to + 2.0g

oard spoilers when used as a longitudinal control device:

Airspeed limit 245 KTS or Mach .60 . . . 0.5g to + 2.0g

RIZONTAL STABILIZER SETTINGS FOR TAKEOFF
° Takeoff Flap Setting)

keoff stabilizer trim setting is normally determined by use
the TWA stabilizer trim computer or the stabilizer trim
irt in section 15.35.

ieralized stabilizer takeoff settings have been approved as
lows:

Center of Gravity Condition	Stabilizer Setting
Forward (19 - 26%)	Six degrees airplane nose up
Midship (25 - 29%)	Four degrees airplane nose up
Aft (28 - 32%)	Two degrees airplane nose up

DRAULIC SYSTEM LIMITATION

e maximum allowable hydraulic fluid temperature is 80°C
0°F). Refer to Emergency Procedures, chapter 03, for
draulic system operation when an overheat condition is en-
intered.

EED BRAKE/SPOILER SYSTEM LIMITATION

eed brake operation in the restricted (placarded) range is
rmissible only for emergency descent, landing roll braking,
i split-spoiler emergency procedures.

AUTOPILOT AND YAW DAMPER LIMITATIONS

When using the automatic pilot, the pilot or co-pilot must be in his seat with his safety belt fastened so that if the automatic pilot should malfunction, he can regain control of the aircraft immediately.

The autopilot and yaw damper must be disengaged prior to take-off and landing.

REMOTE COMPASS SYSTEM LIMITATION (BENDIX)

Whenever heading information is required by the pilots, the two Bendix systems (two RMI and two FPI indicators) should be frequently checked against each other and against the magnetic standby compass to detect obvious errors in indication.

WINDSHIELD HEAT LIMITATION

To provide birdproof resistance, the windshield heat switches must be in anti-fog for all operations except when ice conditions are encountered.

With either pilot's main or center windshield panel anti-fog system inoperative, airspeed must not exceed 298 KTS IAS when operating below 10,000 feet pressure altitude.

RAIN CLEARING SYSTEM LIMITATIONS

Do not operate system on the ground during pre-takeoff engine run-up. Turn system on immediately prior to brake release for takeoff and turn system off following aircraft cleanup. System may be operated during normal cruising, approach, landing and taxiing maneuvers as required.

CAUTION

DO NOT USE THE RAIN CLEARING SYSTEM FOR PRE-FLIGHT WINDSHIELD ICE AND SNOW CLEARING ON THE GROUND.

CABIN PRESSURIZATION LIMITATIONS

Normal operation . . . . . 8.3 ± 0.1 PSI

Relief valve setting . . . . 8.5 ± 0.1 PSI

Cabin must be depressurized for takeoff and landing.

NORMAL STATIC PRESSURE SYSTEM LIMITATIONS

LOSS OF NORMAL STATIC SOURCE

Captain's static system faulty:

Prior to selecting Alternate Static Source open Pilot Air Data circuit breaker on panel C.

Select alternate static system.

Observe following maximum speeds for speed stability system inoperative:

Emergency descent - 375 KTS (.78M)
All other conditions - 335 KTS (.73M)

NORMAL STATIC PRESSURE SYSTEM LIMITATIONS (Cont'd.)

First officer's static system faulty:

Select alternate static source.

Observe following maximum speeds for speed stability system inoperative:

Emergency descent - 375 KTS (.78M)
All other conditions - 335 KTS (.73M)

GENERATOR SYSTEM LIMITATIONS

MAXIMUM CONTINUOUS GENERATOR LOAD

Ground conditions: Generators are self cooled and rated at 40 KVA (111 amps).

Flight conditions: Generators are blast air cooled and rated at 45 KVA (126 amps).

GENERATOR OVERLOAD

Ground and flight conditions:

50% overload (166 amps) for 5 minutes.
100% overload (222 amps) for 5 seconds.

NOTE
Reduce electrical load as required so as not to exceed above load limitations.

GENERATOR/FREON COMPRESSOR OPERATING LIMITATIONS

IN FLIGHT

Operate one Freon compressor only from two or more paralleled generators.

Operate two Freon compressors only from three or more paralleled generators.

ON GROUND

Operate one Freon compressor only from three or more paralleled generators.

Operate two Freon compressors only from four paralleled generators.

SCAT SYSTEM LIMITATIONS

SCAT system indications shall not be used for two engine approaches or two engine go-arounds.

AUTOTHRUST SYSTEM LIMITATIONS

Autothrust, when installed, must be disengaged for takeoff.

EN ROUTE CLIMB SPEED - 2 OR 3 ENGINE

Gear and Flaps Up - 1.7 V_S.

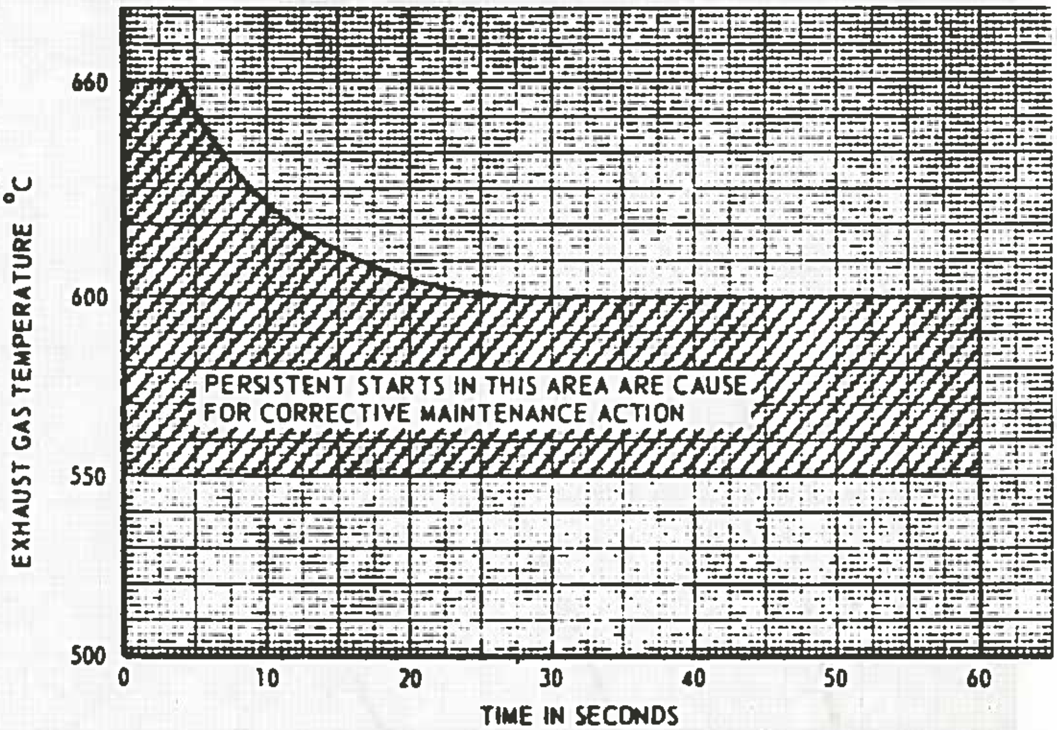
GROSS WEIGHT 1000 POUNDS	SPEED KNOTS
180	242
170	236
160	229
150	222
140	214
130	206
120	198

STALL SPEED (IAS)

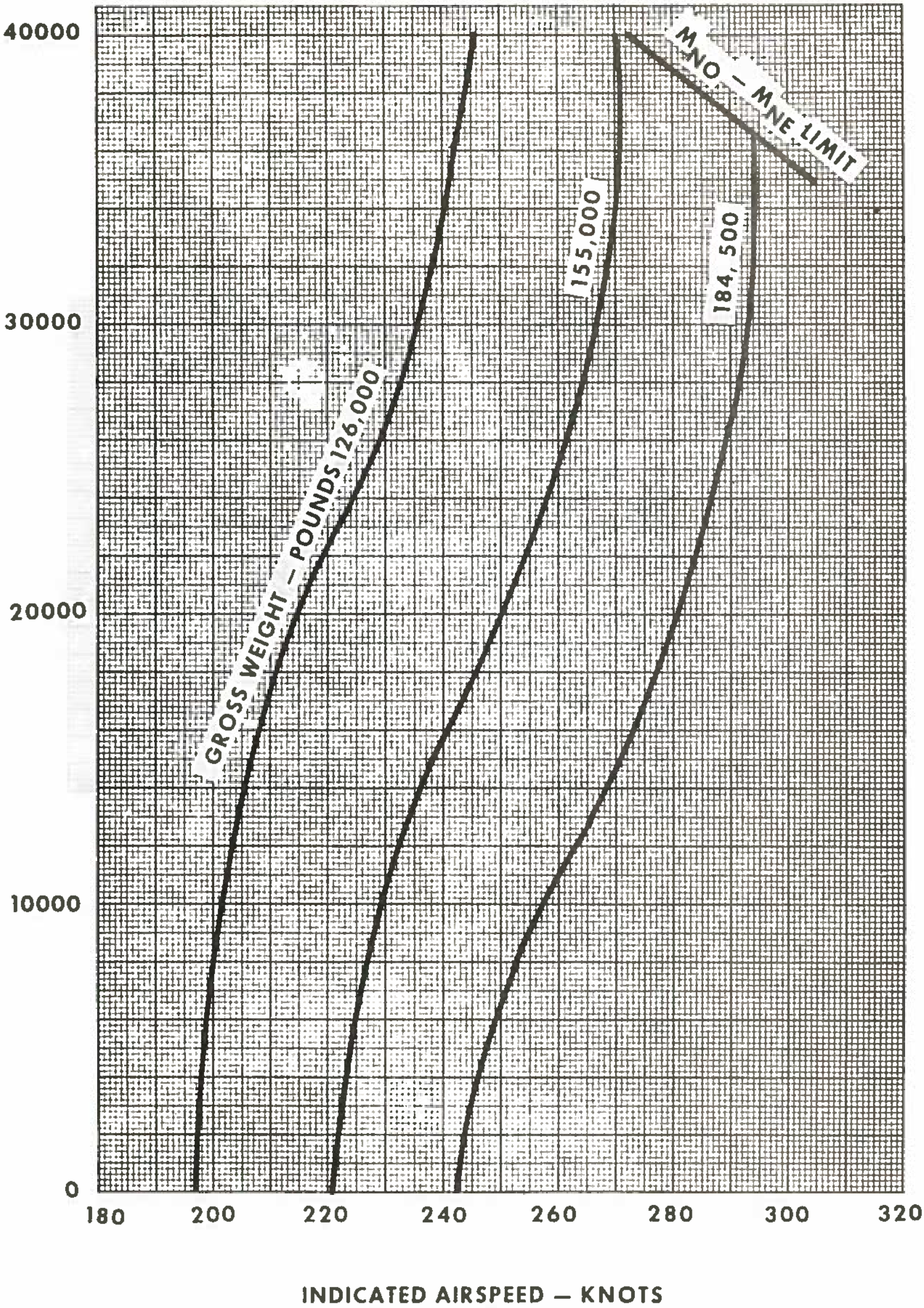
G.W.	FLAPS UP	20°	30°	50°
184,500	151	142	141	138
170,000	146	137	136	133
160,000	142	133	132	130
150,000	137	129	128	126
140,000	133	124	123	121
130,000	128	120	119	117
120,000	123	116	115	113

* * *

A. EXHAUST GAS TEMPERATURE LIMITS - ENGINE STARTING



3. MANEUVERING SPEED (V_A)

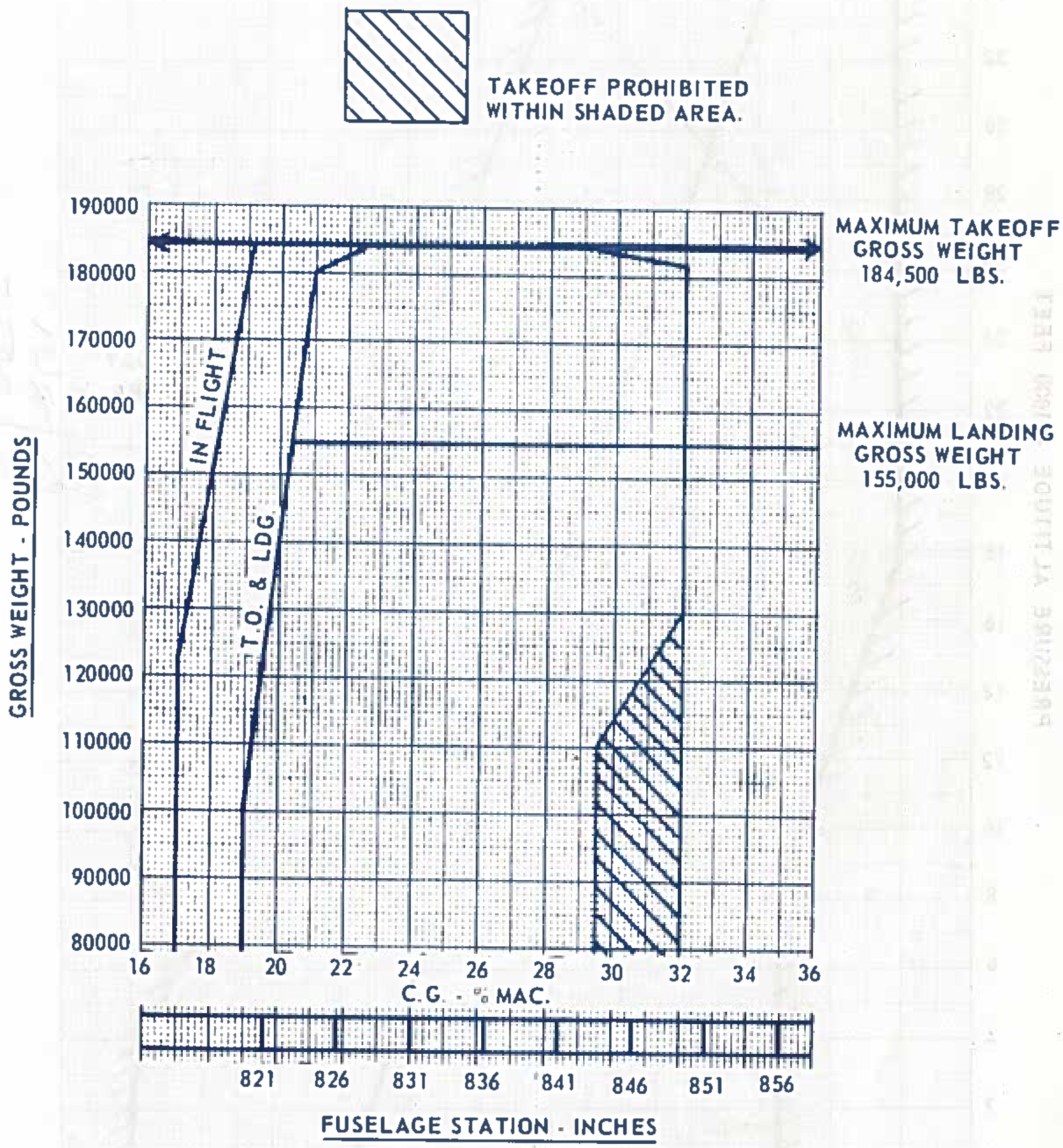


C. CENTER OF GRAVITY LIMITS

Center of Gravity travel due to fuel usage, passenger movement and other items is controlled by the Approved Loading Schedules and Master Equipment List, Convair Reports ZW-22-021 ''Weight and Balance Report for Airplane Number (Registration Number) Tabular Index System'', and ZM-22-062 ''Master Equipment List Model 22''. Limitations of which must be used for all operations.

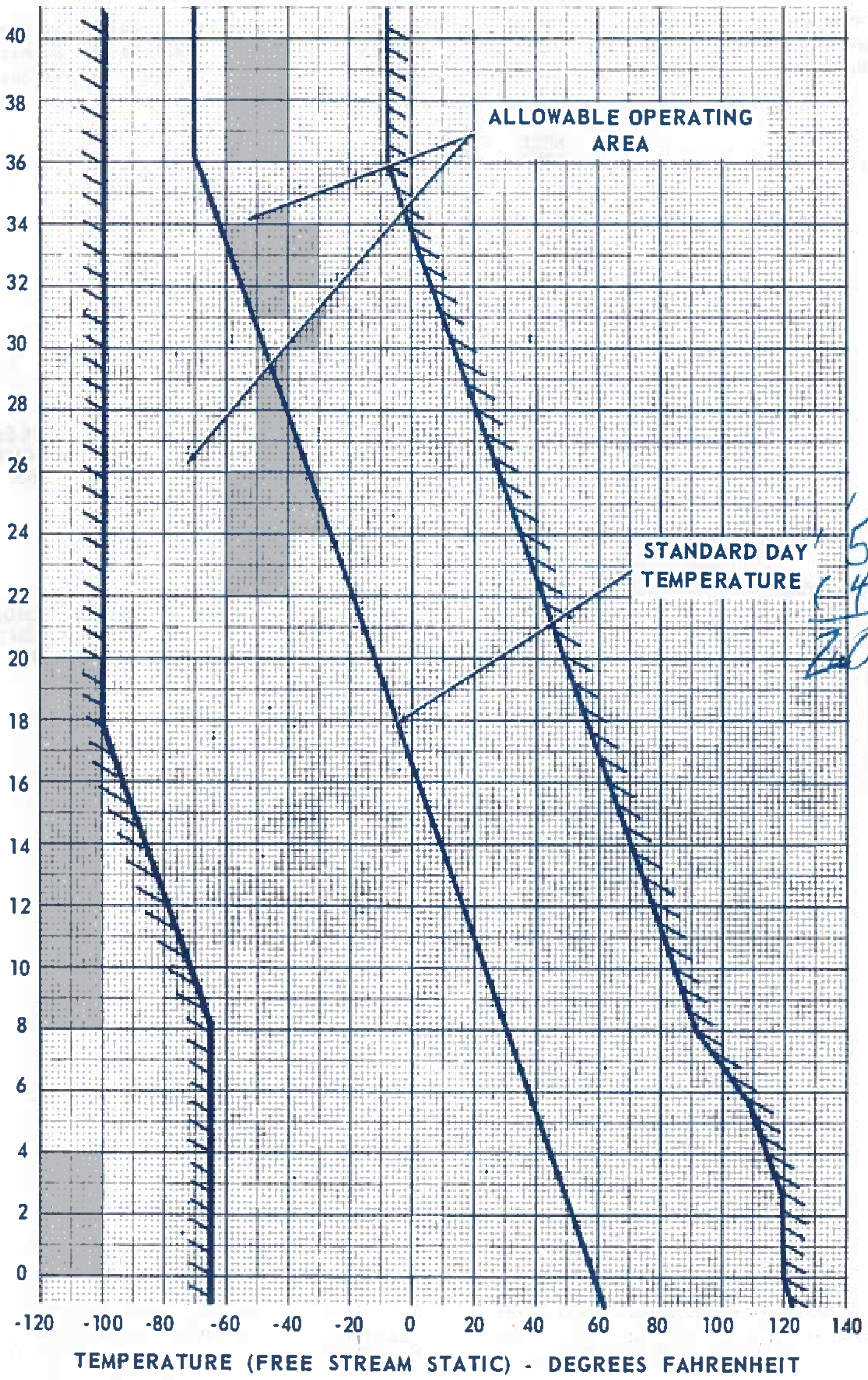
NOTE

Retraction of the landing gear moves the CG forward approximately 0.08% of M.A.C.



(3754)

TEMPERATURE OPERATIONAL LIMITS



1.415
1.415
7075
1415
5660
1415
2002225

* * *

* * *

AURAL TERRAIN WARNING

The installation of aural terrain warning will be accomplished on all aircraft. All radio altimeters will be modified to include this feature.. The warning will consist of a beep tone channeled through the overhead speakers. This tone will be activated during an approach when 500 feet above the terrain. At this time a 2 second beep tone will be heard. When 50 feet from the altimeter bug setting, a beep tone will begin, increasing in volume until bug setting is reached. During the remainder of the approach, beep tone is not activated. The aural modification will be in addition to the visual (MDA light) indication already included as a part of the radio altimeter system.

DEACTIVATION OF THE TURN BANK INDICATOR

FAR 121.305(f) provides for the deactivation of the turn and bank indicators after installation of the standby horizon. The rate-of-turn (needle) portion of the turn and bank indicator is being deactivated on the 880 because of high maintenance costs. The ball portion of the instrument will be retained.

The modification will be accomplished in two phases. Phase one, both turn and bank circuit breakers will be pulled out and banded. The aircraft log will be marked "Turn and bank indicator circuit breakers banded OFF per M.O. 88198". A placard will be placed over the needle portion of the instrument. Phase two will have a modified indicator installed that will have the needle portion of the instrument glass painted over.

ADF SYSTEMS

The 90 to 200 KHz band in the aircraft ADF systems are being deactivated. ADF operation in this band is no longer required, so the ADF control unit will be blocked at 200 KHz by a mechanical stop. This modification will result in a mixed configuration of control units for a period of time.

* * *

USE OF NORMAL CHECK LIST

The procedures to follow when operating the aircraft under normal conditions are described in this chapter.

All operating procedures and limitations as set forth in this handbook shall be adhered to unless deviation is necessary for safety.

Operating procedures that are not considered part of a normal operation, such as de-icing, manual pressurization, etc., are carried under the appropriate system chapter.

The Normal Check List is not intended as a double check on all normal procedures. It is a means of double checking important items during the more critical phases of the operation. The crew should perform the various procedures when called for and use the check list as a true double check. For example, before starting engines the checks which require a significant amount of time to accomplish should be done before reading the check list.

The essential radio switch shall be turned on prior to reading the Before Starting Engines check list and remain on until completion of the Secure Cockpit check list.

The cockpit voice recorder receives power through the essential radio switch.

The captain will normally respond to all pilot items on the check lists except as noted.

The Before Starting Engines and Secure Cockpit check lists will be read by the first officer. The engineer will read the remaining sections. The first officer will answer for all the pilot items on the After Takeoff, Landing Final (except boxed item) and After Landing sections of the check list.

The engineer will silently perform his own challenges and responses.

When the requested check list is complete, the crew member reading the list will advise "_______ check list complete."

When a check list answer is "Check", this indicates the control is in the desired position, not necessarily that the system has been operationally checked. For example, EXTERIOR LIGHTS . . . CK indicates the position of the exterior light controls has been visually checked for the proper position, not that all lights will operate. When an operational check of a system is required, the answer to the check list challenge will be two-fold, such as RADIOS . . . ON & CK.

There are items on the check list that will be accomplished prior to reading the check list. When the captain calls for the check list, this is his command for the check list to be read and complied with.

The following outlines when the various check list sections are to be completed. It is recognized, however, that conditions can dictate some deviation.

Before Starting Engines - When the operating cockpit crew is in the cockpit and after the time consuming checks have been completed.

After Starting Engines - When all engines have stabilized at idle RPM and prior to brake release for taxi from the station. Additionally, after restarting any engine that has been shut down during taxi.

Taxi - After the wing flaps have reached the takeoff position and after restarting an engine that has been shut down during taxi. This check list will be completed before reaching the runway.

Before Takeoff - After receiving takeoff clearance and approaching the takeoff end of the runway, or, when in position and holding when takeoff clearance is imminent.

After Takeoff - Any time after flap retraction has been initiated.

Landing Preliminary - Ten to fifteen minutes before estimated time of arrival or whenever possible before beginning descent or when leaving FL 180 or lowest usable flight level.

Landing Final - After initial flap extension and prior to final fix and/or gear extension. Prior to gear extension, the compliance with said check list will be accomplished down to the boxed items.

After seeing three green lights, the captain will command "Complete the check list." The engineer will then read aloud and answer for the boxed items. After these responses, the engineer will announce verbally, "Final Check List Complete."

After Landing - When landing roll phase is completed and starting to taxi.

Secure Cockpit - After all start levers are OFF.

WARNING LIGHT CHECKS

During preflight checks of warning or annunciator lights, all bulbs in each light fixture must be operative.

CREW COORDINATION

Crew duties, as set forth in this handbook, are generally common to all TWA aircraft.

Crew members will normally adhere to their specific duties, as outlined herein. They should not assume the duties assigned to another crew member unless directed to do so by the captain. Each subordinate crew member is responsible to the captain for the proper handling of his station functions. The greatest safety and crew coordination can only be achieved when each crew member performs the duties and functions for which he is responsible.

When the first officer is flying the aircraft, the captain will maintain his feet in a normal position on the rudder pedals and closely monitor all controls during the critical stages of takeoff, climb, approach and landing. The captain will also perform those procedural duties normally assigned to the first officer. The exception would be items that can only be accomplished by the first officer due to physical location of controls and switches. Any time the captain desires to take over the controls, he will call out "I've got it", when he has the controls for all three axes. The first officer will then relinquish the controls and resume his normal duties.

Crew members will repeat the captain's commands to indicate they understand and are complying with the command.

After receipt and confirmation of any ATC clearance, the captain will repeat aloud his understanding of the clearance to assure that all crew members are aware of the altitude and clearance limit to which the flight is cleared.

CREW COORDINATION (Cont'd)

The first officer will assist the captain by silencing the gear warning horn when the throttles are retarded during normal en route operation.

All cockpit crew members shall assist the captain in monitoring and cross checking instruments, bug settings, assigned altitudes and headings, control positions including flaps, spoilers, landing gear, stabilizer position, etc. A crew member shall immediately call to the captain's attention any discrepancy noted.

INSTRUMENT APPROACH

The first officer and engineer shall assist in traffic watch, monitor position indicators, flight and engine instruments and promptly inform the captain of any observed malfunctions or irregularities. Specific attention shall be focused on altimeter accuracy and setting, airspeed bug setting, flap positions and all fail warnings associated with flight instruments.

Prior to reaching the final fix on final, the captain and first officer shall review the approach plate. The first officer shall call out, for the captain and engineer, the field elevation, altitude (MSL) at which the approach will be discontinued and time to missed approach where applicable.

When the localizer or glide slope start moving in from full deflection the first officer shall call out "Localizer Alive" or "Glide Slope Alive" as applicable.

When reaching the final fix, the captain will verbally announce the fix and the first officer will respond with "Flags Checked" after checking flag status on each pilot's panel. Any instrument showing a flag will be called to the attention of the captain.

If the captain should fail to announce the fix, the first officer should then announce the fix and the flag check.

Upon leaving the final fix, the first officer will monitor HDI, FPI and altimeters during the remainder of the approach for warning flags. Any instrument showing a flag will be called to the attention of the captain.

The first officer will call out "Localizer" or "Glide Slope" with one dot width's deviation from either the localizer or glide slope down to the 500 foot check.

When 500 feet above the field, the captain will call "500 feet" and the first officer will respond with the actual airspeed and sink rate as, "130 KTS - Sink 700." If this level has been passed prior to call out, the actual altitude will also be called.

If the captain fails to call 500 feet, the first officer will do so. It will be the responsibility of the engineer to do so, without undue time lapse, should neither pilot have called out this information.

After leaving the 500 foot check any sink rate in excess of 1000 feet per minute will be called by the first officer.

When 100 feet above the minimums, the captain will call "100 to go."

When approaching minimums, the first officer will advise the captain as visual cues associated with the approach appear such as sequence flashers, approach lights and runway lights or associated cues. Do not descend below DH or MDA unless such visual cues are clearly visible. Without the cues, "Minimum No Runway" shall be called and a missed approach executed.

* * *

FAA APPROVED
5/13/74

NORMAL 880 CHECK LIST

BEFORE STARTING ENGINES

AT THROUGH STATIONS (NO MECH DELAY OR CREW CHANGE), NECESSARY TO READ ONLY BOXED ITEMS

PILOTS

1. GEAR LEVER & LIGHTS .... DOWN & CK
2. PARKING BRAKE .... ON
3. BRAKE PRESSURE .... CK
4. ALTIMETERS & CLOCKS .... SET & CROSS CK
5. FLIGHT INSTRUMENTS .... CK
6. RADAR & TRANSPONDER .... STANDBY
7. FIRE CONTROLS .... CK
8. RADIOS .... ON & CK
9. COMPASSES .... SYNC & SLAVE
10. WINDSHIELD HEAT .... ANTI-FOG
11. EMERGENCY EXIT LIGHTS .... OFF
12. EXTERIOR LIGHTS .... CK
13. BETA BOX .... CK
14. NOSE BRAKE SWITCH .... NORMAL
15. EMERGENCY BRAKE PRESSURE .... CK
16. EMERGENCY BRAKES .... OFF
17. STATIC SELECTORS .... NORMAL
18. AUX EQUIP SELECTOR .... ON
19. FLAP HANDLE .... SYNC
20. AUX PUMP & HYDRAULIC PRESSURES .... CK
21. KIFIS & SPEED STABILITY .... CK
22. FLIGHT INSTRUMENT SELECTORS .... ALL NO. 1
23. V_{mo} WARNING .... CK
24. DRAG BRAKE LEVER .... NORMAL DET
25. SPOILER SELECTOR .... NORMAL
26. SPOILERS .... DOWN
27. AUTOPILOT .... CK & OFF
28. FLIGHT DIRECTORS .... CK & SCAT
29. STABILIZER CONTROL .... CK & NORMAL
30. TRIM TABS .... CK
31. EMERGENCY GEAR RELEASES .... STOWED
32. ESSENTIAL BUS SEL .... EXT PWR
33. ISOLATION SWITCHES .... AUTO
34. ENGINE & WING ANTI-ICE .... CK & OFF
35. IGNITION SELECTOR .... BOTH
36. NO SMOKING .... ON
37. ANTI-SKID .... CK & ON
38. WARNING LIGHTS .... CK
39. OXY MASK & REGULATOR .... CK & EMERG OFF

ENGINEER

1. BATTERY .... NORMAL
2. LOAD REDUCTION SWITCHES .... CK & ON
3. OIL QUANTITY .... CK
4. FUEL QUANTITY ....
5. FUEL PANEL .... CK & SET
6. AIR CONDITIONING PANEL .... CK & SET
7. PRESSURIZATION CONTROLS .... AUTO & SET
8. EQUIPMENT COOLING .... FAN ON
9. HYDRAULIC QUANTITY .... CK
10. OXYGEN SYSTEM .... ON & CK
11. CIRCUIT BREAKERS & LIMITERS .... CK
12. DC POWER .... CK
13. AC POWER .... CK & ON MAIN
14. EMERGENCY INVERTER .... OFF
15. GENERATOR CONTROLS .... CK
16. JETTISON & SCAVENGE SWS .... CLOSED
17. ALT PRESS SOURCES .... CLOSED
18. TURBOCOMPRESSORS .... OFF
19. ENGINE HYDRAULIC PUMPS .... ON
20. OXY MASK & REGULATOR .... CK & EMERG OFF
21. GEAR PINS .... REMOVED

AFTER STARTING ENGINES

PILOTS

1. ESSENTIAL BUS SEL .... CK - ON EXT PWR
2. EXCESS HEAT & ISOLATION .... CK & AUTO
3. BEACON LIGHTS .... ON
4. DOOR LIGHTS .... CK
5. START LEVERS .... RUN DETENT
6. FLIGHT CONTROLS .... CK

ENGINEER

1. FLIGHT RECORDER .... ON
2. FUEL PUMPS .... MAINS ON
3. CROSSFEED VALVES .... CLOSED
4. ELECTRICAL POWER .... CK
5. AUX HYDRAULIC PUMP .... OFF

TRANS WORLD AIRLINES
CONVAIR 880
FLIGHT HANDBOOK

FAA APPROVED
5/13/75

NORMAL 880 CHECK LIST

PILOTS | ENGINEER

TAXI

PILOTS		ENGINEER	
1. FLAPS	INDICATE 20°		
2. SCAT	CK		
3. PITOT HEATERS	ON		
4. ENGINE ANTI-ICE			
5. STABILIZER TRIM	SET & CROSS CK		
6. T.O. DATA/AIRSPEED BUGS	SET & CROSS CK		

BEFORE TAKEOFF

PILOTS		ENGINEER	
1. CABIN ALERT	CK	1. TURBOCOMPRESSORS	CK
2. TRANSPONDER	CK		
3. IGNITION	FLIGHT START		

AFTER TAKEOFF

PILOTS	
1. YAW DAMPER	ON
2. GEAR LEVER	NEUTRAL
3. IGNITION	OFF
4. LANDING LIGHTS	RETRACT & OFF
5. LOGO LIGHT	OFF
6. SEAT BELT/NO SMOKE	CK

LANDING PRELIMINARY

PILOTS		ENGINEER	
1. SEAT BELT	ON	1. CABIN ALTITUDE	CK
2. LOGO LIGHT	CK	2. REPLENISH PUMPS	CK
3. ANTI-ICE SYSTEMS	CK	3. CIRCUIT BREAKERS	CK
4. EMERGENCY BRAKE PRESSURE	CK		
5. GW/AIRSPEED BUG	SET & CROSS CK		
6. ALTIMETERS	SET & CROSS CK		
7. GO AROUND EPR	SET		

LANDING FINAL

PILOTS		ENGINEER	
1. ALTIMETERS	SET & CROSS CK	1. FUEL PUMPS	MAINS ON
2. NO SMOKING	ON	2. CROSSFEED VALVES	CLOSED
3. YAW DAMPER	CK		
4. BRAKE & HYD SYSTEM PRESSURES	CK		

WHEN GEAR EXTENDED

5. GEAR & ANTI-SKID	DOWN & CK
6. FLAPS	______ DEGREES
7. HYDRAULIC QUANTITY	CK

AFTER LANDING

PILOTS		ENGINEER	
1. BRAKE PRESSURE	CK	1. AUX HYDRAULIC PUMP	ON
2. RADAR & TRANSPONDER	OFF	2. TURBOCOMPRESSORS	OFF
3. FLAPS	UP	3. ALT PRESSURE SOURCES	CLOSED
4. SPOILERS	DOWN	4. RECIRC FAN	ON
5. STABILIZER	2°	5. PRESSURE REGULATORS	AUTO
6. PITOT & WING HEAT	OFF		

SECURE COCKPIT

PILOTS		ENGINEER	
1. PARKING BRAKF	ON	1. AUX HYDRAULIC PUMP	OFF
2. EMERGENCY EXIT LIGHTS	SHUT DOWN	2. FUEL PUMPS	OFF
3. ENGINE & WINDSHIELD HEAT	OFF	3. FLIGHT RECORDER	OFF
4. BEACON LIGHTS	OFF	4. FLT TERM-WATER PUMP	OFF
		5. FLT TERM-OXYGEN SYSTEM	OFF

RADIOS .... OFF

* * *

BEFORE STARTING ENGINES CHECK LIST AMPLIFICATION (Cont'd.)

16. EMERGENCY BRAKES . . . . OFF

Check that emergency brake control is in OFF position.

Confirm no emergency brake pressure applied by checking for zero pressure reading on line test indicator.

17. STATIC SELECTORS . . . . NORMAL

Physically check position of captain and first officer's selectors to ensure they are in the NORMAL detent. Errors will exist in airspeed, mach and altimeter if not in correct position. Reference FHB 07.01 section for errors in ALT position.

18. AUX EQUIP SELECTOR . . . . ON
Physically check to ensure this valve is in the ON position. Reference FHB 07.01 section for items affected if in OFF position.

19. FLAP HANDLE. . . . . SYNC
To prevent any flap movement when the aux. hydraulic pump is turned ON, place flap handle in position that corresponds to indicated flap position.

20. AUXILIARY PUMP & HYDRAULIC PRESSURES. . . CK
Pressurize both hydraulic systems to provide pressure for brakes and for checking hydraulic units as necessary.

A pressure of 1900 PSI or more, on both system indicators, is acceptable from the auxiliary pump. Check that pump Low pressure lights are ON and Supply Pressure Low lights go OUT.

21. KIFIS & SPEED STABILITY. . . . . CK
Place auxiliary hydraulic pump ON. This is required for stabilizer movement.

Place captain and first officer's KIFIS test switches to TEST position.

Check for both altimeters increasing 350 plus or minus 50 feet. (Exception: If at an airport which is approximately 5000 feet in elevation, altimeters may not be within the required tolerance).

Release first officer's KIFIS test switch and observe altimeter returning to original indication.

Check for TAS indicating 496 plus or minus 5 knots.

Check for SAT indicating -80 plus or minus 1 degree.

Check for stabilizer position indicator increasing 1.6 degrees from previous indication. The speed stab fail light will illuminate momentarily until the stabilizer is repositioned. The stabilizer trim wheels should not rotate.

Release captain's KIFIS test switch and observe all instruments returning to original indications.

22. FLIGHT INSTRUMENT SELECTORS . . . . . ALL #1
Check for HOR GYRO switch being in the #1 position.

Check for FLT DIR COMMAND switch being in the #1 position.

Check for COMP SEL switch being in the #1 position.

Check for VOR switch being in the #1 position.

23. V_{mo} WARNING . . . . CK
Depress V_{mo} - M_{mo} WARN TEST button, checking for intermittent bell.

24. DRAG BRAKE LEVER . . . . . NORMAL DETENT
Check that lever is in NORMAL DETENT. If lever is not secure in detent, mechanical interference would occur when attempting to retract gear normally.

25. SPOILER SELECTOR . . . . NORMAL
Check that Spoiler Selector switch is in NORMAL position If necessary to reposition the switch to Normal, extend spoilers and have a crew member visually check that all spoilers extend equally. This assures that linear actuators are in the proper position. Return spoiler handle to DOWN detent after visual check.

26. SPOILERS . . . . DOWN
The handle should be full forward and pushed down into the detent.

27. AUTOPILOT . . . . CK & OFF
Yaw Damper Check
Place switch in YAW DAMPER position. Check for stiff rudder pedal action.
Return switch to OFF position. Check that rudder pedals now move freely. Check that autopilot flashing disengage light illuminates. Press to extinguish.

Autopilot Check
Place switch to AUTOPILOT position.
Operate turn controller and note proper turning response of control wheel.
Operate pitch wheel and note proper forward and aft movement of control column, and note movement of normal trim wheel.
Place Altitude Hold switch ON. Check pitch wheel being ineffective.
Depress captain's Autopilot disconnect button. Check autopilot has disengaged and controls are free. Disengage light will not illuminate.

28. FLIGHT DIRECTORS . . . . CK & SCAT
Flight Director Check
Select HDG mode on both mode selectors. Center HDG cursors on lubber lines. Turn each HDG cursor to left and right of lubber line and observe command bars indicating proper commands.
Rotate Pitch Trim Command knobs and check for climb and descent commands.
Place ALT HOLD switches ON. Check for pitch trim command being ineffective.
Place the FLT DIR COMMAND switch to the #2 position. Check both command bars indicating same angle of bank when the first officer turns his HDG knob.
Each flight director will be disengaged by depressing respective autopilot disconnect button. Mode selector will trip to SCAT mode.

SCAT and Autothrust Check
Check for slow-fast flags out of view.
Slow-fast indicators will indicate slow.
Command bars will show same degree of fly down command.
Engage autothrust and throttles will move forward.
Depress autopilot disconnect button and throttle movement will stop. The autothrust flashing light will illuminate.
Return throttles to closed position and press light to extinguish.

29. STABILIZER CONTROL. . . . . CK & NORMAL
Place stabilizer trim hydraulic shutoff switch to CLOSE. Check that stabilizer will not operate when a normal trim wheel is actuated by hand rotation.

FORE STARTING ENGINES CHECK LIST AMPLIFICATION (Cont'd.)

PILOTS

Hold Electric Standby Stabilizer Control switch to NOSE UP and check that the emergency trim wheels rotate in the proper direction. Confirm stabilizer movement by observing position indicators. The normal trim wheels will move in the same direction as the emergency wheels when approximately one to two units of stabilizer movement has occurred. Check for proper nose down stabilizer operation in the same manner. During these checks, normal operation of the standby motor clutch is indicated by almost immediate stopping of the emergency trim wheels when the switch is released, accompanied by an audible coast down of the motor.

CAUTION

Do not operate to either extreme of travel with the electric standby system to prevent damage to the trim actuator.

Return stabilizer hydraulic shutoff switch to OPEN.

Check captain's and first officer's aileron wheel thumb switches in each direction. Confirm proper stabilizer movement by observing normal trim wheels and stabilizer position indicators.

CAUTION

Use thumb switches only to the extent necessary to confirm their normal operation. Refrain from large stabilizer movements or continuous thumb switch use when auxiliary pump is the only source of hydraulic pressure, due to insufficient hydraulic volume.

. TRIM TABS . . . . CK
Check aileron and rudder trim tab for freedom and align aileron and rudder trim indicators to 0. (R-O-L)

. EMERGENCY GEAR RELEASES . . . . STOWED
Check that both nose and main releases are flush with the pedestal rear surface.

. ESSENTIAL BUS SELECTOR . . . . . EXTERNAL POWER
The Pilots Essential bus is being powered by the ground power unit through the Sync bus.

. ISOLATION SWITCHES . . . . AUTO
This allows the isolation valves to open and provide starting air for engines 1 and 2 when the bleed air manifold is pressurized.

. ENGINE & WING ANTI-ICE . . . . CK & OFF
Place all engine anti-ice switches to ON position. Check that malfunct lights come on. Return switches to OFF position.

If any malfunct light is on with switch off it indicates the front frame pressure switch is in the pressure on position.

Place wing anti-ice switch to the ON position. If bleed air manifold is not pressurized, the six wing anti-ice valve closed lights will come on steady. If manifold is pressurized, lights should come on momentarily then go out. Wing anti-ice switch must be off for engine starting.

The blue anti-ice on light will be on when any engine anti-ice switch or the wing anti-ice switch is on.

35. IGNITION SEL . . . . BOTH
Confirm ignition selector switch in BOTH position, utilized during all normal system operation.

36. NO SMOKING . . . . ON
Place switch to NO SMOKING position to illuminate No Smoking, Return to Cabin and Fasten Seat Belt signs in cabin.

37. ANTI-SKID . . . . CHECK & ON

Push-to-test all indicator lights.

Check Main system.
Place anti-skid switch OFF. Check for main inoperative light ON, after approx. 3 second delay.
Place anti-skid switch ON. Check main inoperative light goes out.

Check Nose system.
Check nose brake deactivation switch NORMAL.
PULL nose Anti-skid control circuit breaker C-8.
Check nose inoperative warning light comes on.
Reset circuit breaker. Check nose inoperative light goes out.

38. WARNING LIGHTS . . . . CK
Place warning light test switch to either BRIGHT or DIM and check:

All rectangular or square warning lights will illuminate except:

Autopilot disconnect
Radio altimeter MDA

No round warning lights will illuminate.

39. OXY MASK & REGULATOR . . . . CK & EMERG OFF

Check connection of oxygen hose and mike cord. Clean mask.

Check emergency oxygen:
Hold mask away from face. Place all regulator levers to the up position. Check flow indicator for continuous oxygen flow.

Place emergency lever to NORMAL. Oxygen flow should stop.

Check mask:
Don mask and adjust for a leakproof fit. Be certain mask will not pull away from face when performing cockpit duties.

Check regulator:
Place supply lever to OFF. No flow (oxygen or ambient air) should be available when inhaling.

Place oxygen lever to NORMAL. Ambient air should be available but no oxygen flow should be indicated when inhaling.

Place supply lever to ON. Oxygen flow should be indicated when inhaling.

Place oxygen lever to 100%. Oxygen flow should be indicated when inhaling.

Check mask microphone:
Place mike selector to interphone. Press mask mike switch. Check output with headset or speaker.

BEFORE STARTING ENGINES CHECK LIST AMPLIFICATION (Cont'd.)

Place both mask head straps in quick-release strap. Ensure release (pin) end of strap is facing wearer.

Ensure smoke goggles are available.

At the time the check list is read reconfirm that emergency levers are normal including those at the ACM station.

ENGINEER

1. BATTERY . . . . NORMAL

   In this position the battery is:

   Connected to the charger.

   Not connected to either DC bus.

2. LOAD REDUCTION SWITCHES . . . . ON

   Place load reduction switches OFF and notice the respective amber lights glow. Return switches ON and note load reduction lights are out.

   NOTE

   If only main external plug is powered, both load reduction lights will be on. After aircraft generators are powering systems, note that both load reduction lights go out.

3. OIL QUANTITY . . . . CK

   Each engine is normally serviced to approximately 3 gallons, however, 2.5 gallons or more is satisfactory indicated quantity. If less than 2.5 gallons is indicated, the tank must be serviced to at least 2.5 gallons.

   The indicated quantities should be noted on the fuel log for future reference.

4. FUEL QUANTITY . . . . ______LBS.

   Response to this should be brake release (Takeoff) fuel on board to provide a double check for the captain.

   Check the fuel quantity indicating system by placing fuel quantity selector switch to REPLENISH a few moments and release. Quantity should return to original indicated quantity.

5. FUEL PANEL . . . . CK & SET

   Turn all boost and transfer pumps ON and check that all low pressure lights go out (transfer pump lights come on momentarily then go out). Turn all pumps OFF. When ready to start engines, turn on both #1 boost pumps.

   NOTE

   With external power main plug only supplying the aircraft, all pumps cannot be checked until after electrical system powered from aircraft generators.

   Check each line and crossfeed valve, by use of the transit light, for being open. This includes the emergency crossfeed valves since engine starting will be done with #1 tank fuel to purge the crossfeed lines of any trapped air.

   Check both de-fuel switches in CLOSED position and both indicator lights out.

6. AIR CONDITIONING PANEL . . . . CHECK & SET

   RECIRC FAN ON
   This provides air circulation for heating and cooling on the ground.

   FREON SELECTOR & PACK SWITCHES CK
   To start operation of the air conditioning systems on the ground, proceed as follows:

   With the Freon selector switch in BOTH ON position, place R.H. Freon pack switch to ON.

   If only one ground power plug is connected or if the ground power unit is incapable of supplying two Freon systems, do not attempt to start the L.H. system until after engines are started.

   After approximately ten seconds, and if electrical power is sufficient, place the L.H. Freon pack switch to ON.

   Freon packs must always be started one at a time to prevent over-loading the electrical system.

   TURBOCOMPRESSORS OFF
   Turbocompressor switches should be off to prevent the turbocompressors from starting when the bleed air manifold is pressurized.

   ALTERNATE PRESSURE SOURCES CLOSED
   Alternate pressure source switches should be in CLOSED to prevent engine bleed air from entering the air conditioning systems when the bleed air manifold is pressurized.

   TEMPERATURE CONTROLS . . . . AUTO & SET
   Set cabin and flight deck temperature controls at approximately the 11 o'clock position and the selector switches in AUTO.

   TEMP INDICATOR SEL . . . . DUCT

   DUCT TEMP SEL . . . . L.H. EVAP AIR IN
   This permits monitoring the left turbocompressor air temperature during takeoff since it is normally being used.

7. PRESSURIZATION CONTROLS. . . . . AUTO & SET

   Set the pressurization controls as follows:

   Pressure Regulator switches - AUTO
   Both pressure regulator closed lights should be out.

   Cabin Altimeter - Set to local barometric pressure.

   Cabin Altitude Selector - Set cabin altitude pointer 500' above field elevation. Check flight altitude indication in window; if below planned cruise altitude, select flight altitude indication to approximately 2000' above desired cruise altitude. Adjust barometric corrections scale to local barometric pressure.

   Rate Knob - Adjust just out of DEC position.

8. EQUIPMENT COOLING. . . . . FAN ON

   Since takeoff will normally be made using one turbocompressor, the equipment cooling fan is to be left on until the second turbocompressor is operating.

RE STARTING ENGINES CHECK LIST AMPLIFICATION (Cont'd.)

ENGINEER

. HYDRAULIC QUANTITY . . . . CK
With the hydraulic system pressurized the minimum readings should be 1.0 gallons for #1 system, and 3.2 gallons for #2 system.

. OXYGEN SYSTEM . . . . ON & CK

Check that passenger/crew interconnect valve is closed and both manual override handles are horizontal prior to opening any passenger bottle.

Check that all crew and observer regulators have their emergency levers in the NORMAL position and that the observer regulator supply lever is OFF prior to opening the crew bottle.

Slowly open all oxygen bottle valves fully, then return 1/2 turn toward closed.

Check that passenger and crew system pressure is at or above minimum.

. CIRCUIT BREAKERS AND LIMITERS. . . . . CK
All circuit breakers on the 298 bulkhead should be in except:

Breakers that are banded open due to de-activated systems or provisional installations.

ESSENTIAL OVERRIDE CB switches on C panel. These are on only when the on position of the essential radio switch does not supply power to its radio units and electrical power is on the pilot's Essential AC and Emergency DC busses.

The current limiters and circuit breakers below the 298 circuit breaker panels and the engineer's desk, should be checked and any discrepancies corrected.

2. DC POWER . . . . CK
With external power on, all AC load busses powered and all T-R switches On, check the DC system as follows:

Place battery switch to EMER. Note charger relay light ON, battery amperage indicates between zero and a "+" amperage depending on battery condition and that T-R amperages feeding the Emergency bus are different than T-R amperages feeding Essential bus. Both BUS off lights should be out.

Place battery switch to NORMAL and note that charger relay light blinks and goes out, battery amperage between zero and -2 to -10. A battery that continues to accept a -10 amp charge rate for longer than thirty minutes should be written up as faulty.

Place #1, #2, and #3 T-R switches OFF and note that #4 T-R voltage is within limits. An abnormally low voltage will indicate a blown fuse in the AC power lead to the T-R. Place #3 T-R ON and #4 T-R OFF and check #3 as previously described for #4. Repeat with remaining T-R's.

NOTE

With only the Main external power plug installed, #1 T-R cannot be checked until generators are feeding the electrical system.

Return all T-R switches to ON and voltmeter selector to battery position. Note that all T-R amperages are normal. This confirms the T-R switch positions and amperage output after the DC power check.

→13. AC POWER . . . . CK & ON MAIN

Prior to performing this check:

Check that the gear handle is down and the flap handle is synchronized with indicated flap position.
Place cabin Freon switch OFF.
Place aux hydraulic pump ON and check system pressure.
Check main and standby indicator lights, and that the AC selector switch is in the MAIN position.

To check the integrity of the manual and automatic 26V and 115V power transfer system:

Open #3 bus tie relay. Main out light will be illuminated.

Place the selector switch to STANDBY and check:

#1 and #2 hydraulic system pressure dropping toward or at zero.

Gyro flags not visible.

Compass flag is not visible on captain's FPI.

Compass flag is visible on the F/Os FPI.

Select any generator position with the pilot's essential bus selector.

Both gyro and compass flags will appear.

All EGT off flags will appear.

Standby out light will illuminate.

To check the operation of the Emergency Static Inverter:

Place inverter switch ON.

Emergency ignition power on light will illuminate.

EGT off flags will retract from view.

Return switch to OFF AND RESET.

Inverter light will go out.

EGT off flags will reappear.

To restore normal operation:

Place selector switch to MAIN.
Close #3 bus tie relay.
F/Os compass flag and both gyro flags will retract from view.
#1 and #2 hydraulic pressure will increase to original pressure.
Place the pilot's essential bus selector to EXT POWER position.
Captain's compass flag will not be visible.

14. EMERGENCY INVERTER . . . . OFF
Check that inverter switch is in reset and off position and indicator light is out.

15. GENERATOR CONTROLS . . . . CK
The Field switches should normally be on. The Bus Tie and Line switches should be in the closed position.

A. AVERAGE FUEL WEIGHT (LBS/GAL) FOR VARIOUS STATIONS (JET AIRCRAFT)

DOMESTIC

STATIONS

MONTH	ABQ	BAL	BOS	DAY	DEN	JFK	IND	IAS	LAX	MIA
JAN	6.74	6.82	6.84	6.79	6.87	6.82	6.80	6.82	6.80	6.79
FEB	6.72	6.82	6.83	6.78	6.86	6.83	6.79	6.80	6.80	6.79
MAR	6.70	6.79	6.81	6.75	6.84	6.77	6.76	6.78	6.79	6.78
APR	6.66	6.76	6.78	6.72	6.80	6.77	6.72	6.75	6.78	6.77
MAY	6.63	6.72	6.75	6.69	6.78	6.73	6.69	6.72	6.77	6.76
JUN	6.60	6.70	6.71	6.66	6.75	6.70	6.66	6.70	6.76	6.75
JUL	6.58	6.69	6.70	6.64	6.72	6.69	6.64	6.67	6.75	6.74
AUG	6.60	6.69	6.70	6.65	6.73	6.70	6.65	6.68	6.75	6.74
SEP	6.62	6.71	6.72	6.67	6.76	6.70	6.67	6.71	6.75	6.75
OCT	6.66	6.75	6.75	6.70	6.79	6.73	6.71	6.75	6.77	6.76
NOV	6.70	6.78	6.79	6.75	6.84	6.76	6.75	6.79	6.78	6.78
DEC	6.73	6.81	6.82	6.78	6.86	6.80	6.79	6.81	6.79	6.82

STATIONS

MONTH	MKC	OKC	ORD	PHL	PHX	PIT	SFO	STL	TUL	YIP
JAN	6.79	6.76	6.84	6.77	6.80	6.80	6.82	6.78	6.76	6.81
FEB	6.77	6.75	6.83	6.77	6.79	6.80	6.81	6.77	6.75	6.81
MAR	6.74	6.72	6.80	6.75	6.77	6.70	6.80	6.74	6.72	6.78
APR	6.70	6.69	6.77	6.71	6.75	6.74	6.80	6.70	6.69	6.75
MAY	6.67	6.66	6.73	6.67	6.72	6.70	6.79	6.68	6.66	6.71
JUN	6.64	6.63	6.70	6.65	6.70	6.67	6.78	6.64	6.63	6.67
JUL	6.62	6.62	6.68	6.63	6.67	6.66	6.78	6.62	6.62	6.66
AUG	6.63	6.62	6.69	6.63	6.68	6.67	6.77	6.63	6.62	6.67
SEP	6.65	6.64	6.71	6.66	6.70	6.69	6.77	6.66	6.64	6.69
OCT	6.69	6.68	6.75	6.69	6.74	6.72	6.78	6.69	6.68	6.73
NOV	6.74	6.72	6.79	6.72	6.78	6.76	6.80	6.74	6.72	6.77
DEC	6.77	6.75	6.83	6.77	6.79	6.79	6.81	6.77	6.75	6.80

MONTH	AMA	BDL	CLE	CMH	CVG	EWR	OAK	SDF	TPA	TUS
JAN	6.74	6.84	6.76	6.77	6.82	6.83	6.79	6.92	6.84	6.82
FEB	6.73	6.84	6.76	6.77	6.81	6.83	6.78	6.92	6.83	6.81
MAR	6.72	6.81	6.73	6.74	6.78	6.81	6.77	6.89	6.82	6.79
APR	6.69	6.77	6.69	6.71	6.76	6.78	6.76	6.85	6.81	6.77
MAY	6.65	6.74	6.65	6.67	6.72	6.74	6.76	6.83	6.79	6.74
JUN	6.63	6.71	6.62	6.64	6.69	6.71	6.74	6.80	6.78	6.72
JUL	6.61	6.69	6.61	6.62	6.68	6.69	6.74	6.79	6.78	6.70
AUG	6.61	6.70	6.62	6.64	6.68	6.70	6.74	6.79	6.78	6.71
SEP	6.64	6.72	6.64	6.65	6.71	6.72	6.74	6.81	6.78	6.72
OCT	6.68	6.76	6.67	6.69	6.74	6.76	6.75	6.85	6.80	6.76
NOV	6.72	6.79	6.71	6.73	6.78	6.79	6.77	6.89	6.82	6.79
DEC	6.74	6.83	6.74	6.77	6.81	6.82	6.78	6.92	6.83	6.81

B. FUEL DISTRIBUTION

FUEL LOAD POUNDS	#1 and #4 each	#2 and #3 each
20,000	5,000	* 5,000
21,000	5,250	* 5,250
22,000	5,500	* 5,500
23,000	5,750	* 5,750
24,000	6,000	* 6,000
25,000	6,250	* 6,250
26,000	6,500	* 6,500
27,000	6,750	6,750
28,000	7,000	7,000
29,000	7,250	7,250
30,000	7,500	7,500
31,000	7,750	7,750
32,000	8,000	8,000
33,000	8,250	8,250
34,000	8,500	8,500
35,000	8,750	8,750
36,000	9,000	9,000
37,000	9,250	9,250
38,000	9,500	9,500
39,000	9,750	9,750
40,000	10,000	10,000
41,000	10,250	10,250
42,000	10,500	*10,500
43,000	10,750	*10,750
44,000	11,000	*11,000
45,000	11,250	11,250
46,000	11,500	11,500
47,000	11,750	11,750
48,000	* 12,000	12,000
49,000	12,250	12,250
50,000	12,500	12,500
51,000	12,750	12,750
52,000	13,000	13,000
53,000	* 13,250	13,250
54,000	* 13,500	13,500
55,000	* 13,750	13,750
56,000	* 14,000	14,000
57,000	* 14,250	14,250
58,000	* 14,500	14,500
59,000	* 14,750	14,750
60,000	* 15,000	15,000
61,000	* 15,250	15,250
62,000	* 15,500	15,500
63,000	* 15,750	15,750
**63,300	* 15,825	15,825
64,000	Full	16,175
65,000	Full	16,675
66,000	Full	17,175
67,000	Full	17,675
68,000	Full	18,175
69,000	Full	18,675
70,000	Full	19,175
70,913	Full	19,631

* No drip stick reading will be available at this fuel level.

** This is the approximate fuel load for 1 and 4 full. Use indicated quantity to determine additional 2 and 3 fuel needed.

FUEL DRIP STICK CHART WITH AIRCRAFT LEVEL-BASED ON 6.7#/GAL.

This chart is based on the assumption that the main fuel tank is full before any fuel runs into the replenish tank. Quantities shown are main plus replenish fuel.

NOTE

Whenever a drip stick is read the residual fuel in the drip stick must be drained. The height of the fuel in the fuel tank in inches is determined by reading the graduation mark on the drip stick that is aligned with the calibration reading plane.

	TANKS NO. 1 & 4 (OUTBOARD TANKS)			TANKS 2 & 3	
FUEL ANTITY OUNDS)	INBOARD DRIP-STICK	OUTBOARD DRIP-STICK	REPLENISH DRIP-STICK	MAIN DRIP-STICK	REPLENISH DRIP-STICK
2,000	0.2				
2,250	0.8				
2,500	1.4				
2,750	2.0				
3,000	2.6				
3,250	3.1				
3,500	3.6				
3,750	4.1				
4,000	4.6				
4,250	5.0				
4,500	5.5				
4,750	5.9				
5,000	6.4				
5,250	6.8				
5,500	7.2				
5,750	7.6				
6,000	8.1				
6,250	8.4				
6,500	8.8				
6,750	9.2			1.4	
7,000	9.5			2.2	
7,250	9.8			2.9	
7,500	10.2			3.7	
7,750	10.5			4.4	
8,000	10.8			5.2	
8,250	11.2			6.0	
8,500	11.6			6.9	
8,750	12.0	0.6		7.6	
9,000	12.4	1.0		8.6	
9,250	12.8	1.4		9.5	
9,500	13.4	1.8		10.5	
9,750	13.8	2.2		11.7	
10,000		2.6		13.1	
10,250		3.1		14.4	
10,500		3.6			
10,750		4.2			
11,000		5.0			
11,250		5.8			0.6
11,500		7.2			2.2
11,750		8.7			3.9
12,000					5.5
12,250			3.1		6.7
12,500			4.3		7.9
12,750			5.6		8.9
13,000			6.9		9.9
13,250					10.9
13,500					11.8
13,750					12.7
14,000					13.6
14,250					14.4
14,500					15.2
14,750					16.0
15,000					16.8
15,250					17.5

	TANKS NO. 1 & 4 (OUTBOARD TANKS)			TANKS 2 & 3	
FUEL QUANTITY (POUNDS)	INBOARD DRIP-STICK	OUTBOARD DRIP-STICK	REPLENISH DRIP-STICK	MAIN DRIP-STICK	REPLENISH DRIP-STICK
15,500					18.3
15,750					19.1
16,000					19.9
16,250					20.6
16,500					21.4
16,750					22.1
17,000					22.9
17,250					23.6
17,500					24.4
17,750					25.0
18,000					25.7

EXAMPLE

a. Pull tank No. 4 outboard drip stick; if reading is greater than 8.7 inches, go to No. 4 replenish drip stick.

b. Pull No. 4 replenish drip stick; the reading on this drip stick is 4.3 inches. There is a total of 12,500 lbs. of fuel in No. 4 main fuel tank and No. 4 replenish.

D. CONVERSION TABLE POUNDS TO GALLONS

GALLONS OF FUEL

SPECIFIC GRAVITY / LBS. FUEL PER TANK	6.2	6.3	6.4	6.5	6.6	6.7	6.8	6.9	7.0
1,000	161	159	156	154	151	149	147	145	143
2,000	322	317	312	307	302	298	294	290	286
3,000	483	475	468	461	454	447	440	435	428
4,000	644	634	624	616	606	597	588	580	571
5,000	805	793	780	769	757	746	734	725	714
6,000	967	951	937	923	909	896	882	870	857
7,000	1128	1110	1092	1077	1060	1044	1030	1015	1000
8,000	1290	1270	1250	1231	1212	1193	1177	1160	1142
9,000	1452	1428	1406	1387	1363	1343	1324	1305	1275
10,000	1613	1584	1560	1539	1513	1490	1470	1450	1428
11,000	1771	1745	1717	1691	1665	1640	1617	1595	1570
12,000	1935	1903	1873	1845	1817	1789	1763	1740	1713
13,000	2097	2061	2027	2000	1966	1939	1919	1885	1856
14,000	2258	2219	2182	2153	2118	2085	2056	2030	1999
15,000	2420	2378	2340	2305	2269	2238	2204	2175	2140
16,000	2581	2538	2495	2460	2421	2384	2350	2320	2282
17,000	2742	2695	2651	2615	2572	2536	2496	2465	2424
18,000	2903	2852	2805	2765	2721	2681	2641	2610	2557
19,000	3055	3010	2961	2919	2873	2829	2788	2750	2708
20,000	3220	3172	3120	3070	3022	2979	2938	2895	2852
21,000						3130	3090	3040	3000

* * *

FUEL USE PROCEDURE

1. Start on crossfeed from #1 tank.

2. After start, close all crossfeed valves and place all main boost and transfer pumps ON for taxi, takeoff, climb and cruise.

NOTE

If fuel boost pump pressure cannot be supplied to an engine, power reduction may be necessary for climb above 26, 000 ft.

WITH TOTAL TAKEOFF FUEL LESS THAN 63, 000#.

1. Complete remainder of flight with tank-to-engine configuration.

NOTE

When #1 and #4 outboard transfer pump warning lights flicker on and off, then remain off (warning light circuit opened by float switch), place their control switches OFF for the remainder of the cruise portion of flight. Return to ON for descent and approach.

2. With any fuel in 2R or 3R, reduce the quantity in these tanks to minimum when 1R and 4R are empty OR start of descent, whichever occurs first.

WITH TOTAL TAKEOFF FUEL MORE THAN 63, 000 pounds.

1. When stabilized in cruise, OPEN all (except Emergency) crossfeed valves.

2. Place #1 and #4 boost and transfer pumps OFF.

NOTE

DO NOT CLOSE #1 OR #4 LINE SHUTOFF VALVES UNLESS TANK-TO-TANK FUEL TRANSFER IS NOTED.

3. Feed #1 and #2 engines out of #2 tank and #3 and #4 engines out of #3 tank until total fuel in each set of tanks is equal.

4. Return engines to their respective main tanks and complete remainder of flight in this configuration.

NOTE

When #1 and #4 outboard transfer pump warning lights flicker on and off, then remain off (warning light circuit opened by float switch), place their control switches OFF for the remainder of the cruise portion of flight. Return to ON for descent and approach.

5. With any fuel in 2R or 3R, reduce the quantity in these tanks to minimum when 1R and 4R are empty OR start of descent, whichever occurs first.

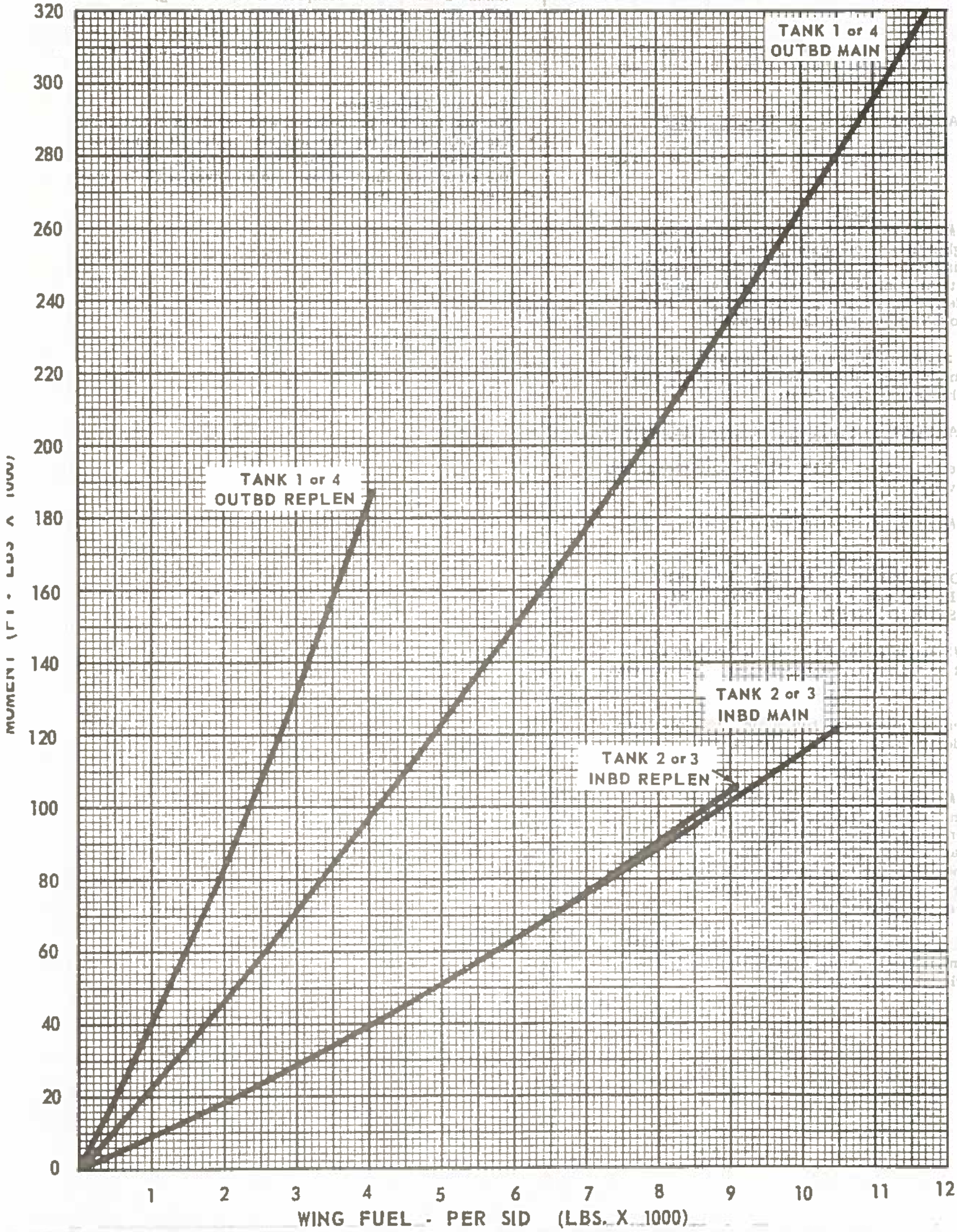
TAKEOFF AND LANDING FUEL DISTRIBUTION LIMITATIONS

1. Structural
   The total inboard fuel shall not exceed the total outboard fuel by more than 3000 lbs. unless the outboard tanks are full at the completion of refueling. If the outboard tanks are full at the completion of refueling, the maximum permissible is that which exists at completion of refueling or 3000 lbs. whichever is greater. There are no structural limitations when outboard fuel exceeds inboard fuel.

2. Fore and Aft Balance
   Normal fuel use procedures will result in maintaining the C.G. within the fore and aft limits. If abnormal fuel distribution is anticipated for landing adhere to the structural limits above and no adverse C.G. problems will be incurred.

3. IN FLIGHT ASYMMETRIC FUEL DISTRIBUTION LIMITS.

1. Read tank quantities.
2. Tabulate moments from graph for L.H. wing and R.H. wing.
3. Add moments for L.H. wing.
4. Add moments for R.H. wing.
5. Subtract smaller from the larger
6. MOMENT DIFFERENCES MUST NOT EXCEED 110,000 FT-LBS.



CREW BRIEFING

The captain will brief cabin attendant A on expected flight time, altitude, etc. Attendant should advise captain of any specific problems concerning passenger service.

Captain and engineer will review the status of the aircraft condition particularly with regard to inoperative items and modifications.

GENERAL

The captain and first officer shall set and lock their chairs in a position which allows full rudder and brake application. Chairs are expected to remain in this position during the critical stages of takeoff, climb, approach and landing.

Anticipate ground crew clearance to start engines four minutes prior to departure time.

If interphone contact is desired before starting engines, turn the beacon lights on. The ground crew will answer this signal, "Ground to cockpit, beacon lights off, go ahead." The beacon lights should be turned off when contact made, if not ready to start engines.

Check that throttles are closed and start levers off.

BEFORE STARTING ENGINES CHECK LIST AMPLIFICATION

PILOTS

1. GEAR LEVER AND LIGHTS . . . . DOWN & CK
Check that gear lever is in down detent. The three green lights and the amber truck position light should be on. The gear unsafe light and door warning light should be out.

2. PARKING BRAKE . . . . ON
Depress toe brakes full travel and pull parking brake handle aft. Check indicator light on.

3. BRAKE PRESSURE. . . . . .CK
Brake pressure should be a minimum of 1500 PSI with the brakes parked. If pressure is below 1500 PSI, synchronize flap handle with position indicator before turning on the auxiliary hydraulic pump.

4. ALTIMETERS AND CLOCKS. . . . . SET & CROSS CK
Check that the KIFIS fail flag is out of view. Set both pilots' altimeters to the local altimeter setting. When resetting the altimeter, always approach the desired pressure setting from a lower pressure.

   Check the indicated altitude, cross check against the other altimeter and compare both altimeter indications with the published ramp elevation. If either altimeter exceeds Category I tolerances, correction must be made before flight. If within Category I tolerances but not within category II tolerances, write up the discrepancy in the aircraft logbook as, "Altimeter not within Category II tolerances." The flight may proceed when destination is forecast to have Category I conditions or higher.

   See the general information section of the TWA Operations (Jeppesen) manual for published ramp elevations and altimeter tolerances.

   Set clocks to correct time.

   Check radio altimeter pointers indicate zero. Check fail flag not visible. To check operation of MDA lights: Set bug below pointer, then increase to above pointer. As bug passes altimeter pointer, MDA lights should illuminate. Push reset button to re-arm MDA warning lights.

5. FLIGHT INSTRUMENTS. . . . . .CK
IAS: Check for IAS pointer indicating zero and V_{mo} M_{mo} pointer indicating approximately 370.

   Machmeter: Check for pointer indicating zero.

   HDI: Superimpose the horizon reference airplane with the horizon bar. Note the pitch trim knob setting so that, if inadvertently changed in flight, it can be repositioned to the correct setting.

   The gyro flag should not be visible. The computer flag will be visible if the mode selector is off.

   FPI: Set course and heading selectors as desired. GS and LOC flags may or may not be visible, depending on the station tuned and the signal strength. Compass flag should not be visible.

   RMI: Compare heading indication with FPI. Set pointer selector as desired. Compass DEV lights should not be on.

   Rate of Climb: Check for pointer indicating zero.

   SHI: Check horizon erect and off flag out of view. If necessary, pull cage knob to erect horizon, then gently release the cage knob and allow it to return to the case.

6. RADAR & TRANSPONDER. . . . . STANDBY
Do not place the switch to any position other than standby or off while the aircraft is being fueled or within 50 yards of another aircraft being fueled.

   Prepare the radar set for operation by setting the controls as follows:

   Gain selector to 12 o'clock.
   Contour switch to NORM.
   Stabilization switch to STAB.
   Antenna tilt switch to zero.

   Code the transponder as required and select code A. Normally use transponder number one for westbound flights, number two eastbound. Select the same altitude reporting source that is used by the pilot flying the aircraft. If either KIFIS system is inoperative, select the operative KIFIS.

7. FIRE CONTROLS . . . . CK
This check is accomplished as follows:

   Check that all four fire controls are pushed in.

   Place test switch to FIRE and note that all red lights in the fire control handles come on steady and the bell rings.

   Press fire bell reset switch and note that bell is silenced.

   Place test switch to OVERHEAT and note that all red lights in the fire control handles flash and the bell rings.

   Depress agent out lights to check bulb condition.

8. RADIOS. . . . . ON & CHECK

   Do not operate radio transmitters while fueling is in progress.

ORE STARTING ENGINES CHECK LIST AMPLIFICATION (Cont'd.)

Place essential and normal radio master switches on.

Audio Selector Panels: Place interphone toggle switch on. Place other toggle switches and mike selector as required for checks and flight operation.

Check ATIS for latest airport information.

Place both Selcal selectors in #2 position for flight operation.

Normally use #2 VHF for company communications. Reference frequencies listed in Radio and Communications Data section, Operations Manual. (Jeppesen)

Normally use #1 VHF for ATC communications.

Tune the ADF using the following procedure:
Select ADF mode and tune desired frequency.
Select SHARP position and adjust for maximum needle deflection.
Select BROAD position to identify station.
Select ADF pointer position on RMI for proper indication.

Where a VOR omni-test (VOT) station is available, the following test procedure should be used.

Tune in VOT frequency on both VOR receivers.
Set either 000 or 180 in each FPI course window.
If 000 selected, the ambiguity pointer should appear opposite the course cursor.
If 180 selected, the ambiguity pointer should appear directly under the course cursor.
The deviation indicator needles on both FPIs should center. If, however, either does not, rotate the appropriate course knob until the needle does center. The maximum permissible deviation on either VOR receiver is $\pm$ 3°, and maximum spread allowed between VOR receivers is 4°. Tune VORs as required for departure. Check for proper station identification.

Place the DME switch to STANDBY and O'RIDE.

9. COMPASSES. . . . . .SYNC & SLAVE

Hold mode selector to SYNC until RMI and FPI cards stop. Check that all heading cards are in agreement.

Return mode selector to slave position. Synchronizer warning light should not be on.

10. WINDSHIELD HEAT. . . . . .ANTI-FOG
Place all five switches to the ANTI-FOG position. This will allow all panels to warm up to the correct temperature for optimum strength. Anti-ice heat can be turned on for the three front windshield panels by placing the three windshield switches to ANTI-ICE.

11. EMERGENCY LIGHTS. . . . . OFF
Place switch to OFF for automatic operation of the emergency lights should normal DC power fail.

12. EXTERIOR LIGHTS. . . . . CK

The wing ice lights should be left on during ground loading at night.

Warning light dimming switch should be checked for daylight operation. This switch affects dimming of all warning and position lights except fire warning, marker, SELCAL, AP disconnect, fuel valve transit, start valve open and individual anti-skid warning.

Turn the navigation lights on at night or during daytime when visibility is poor. Use the on battery position only when the Emergency DC bus is needed for the power source.

Turn the beacon lights on to contact ground crew, or just prior to engine starting and leave on while any engine is running.

Turn logo lights on only during hours of darkness before midnight. Do not turn on for any operation after midnight.

Check that landing lights are positioned as desired for existing conditions.

13. BETA BOX. . . . . CK
Place beta box test switch to ON. Displace rudder pedals from neutral and push hard on rudder pedal that is farthest aft. The green light on indicates the beta box seals are in satisfactory condition. The green light will remain on until the switch is turned off.

When operating rudder, be sure not to release parking brake by depressing the toe pedals.

14. NOSE BRAKE SWITCH. . . . . .NORMAL
In this position, the nose wheel brakes are operational. With switch off, nose wheel brakes are not available.

15. EMERGENCY BRAKE PRESSURE. . . . . .CK
Check indicator for minimum of 1600 PSI. Three full applications are available with this minimum pressure.

BEFORE STARTING ENGINES CHECK LIST AMPLIFICATION (Cont'd.)

16. EMERGENCY BRAKES . . . . OFF

Check that emergency brake control is in OFF position.

Confirm no emergency brake pressure applied by checking for zero pressure reading on line test indicator.

17. STATIC SELECTORS . . . . NORMAL

Physically check position of captain and first officer's selectors to ensure they are in the NORMAL detent. Errors will exist in airspeed, mach and altimeter if not in correct position. Reference FHB 07.01 section for errors in ALT position.

18. AUX EQUIP SELECTOR . . . . ON
Physically check to ensure this valve is in the ON position. Reference FHB 07.01 section for items affected if in OFF position.

19. FLAP HANDLE. . . . . SYNC
To prevent any flap movement when the aux. hydraulic pump is turned ON, place flap handle in position that corresponds to indicated flap position.

20. AUXILIARY PUMP & HYDRAULIC PRESSURES. . . CK
Pressurize both hydraulic systems to provide pressure for brakes and for checking hydraulic units as necessary.

A pressure of 1900 PSI or more, on both system indicators, is acceptable from the auxiliary pump. Check that pump Low pressure lights are ON and Supply Pressure Low lights go OUT.

21. KIFIS & SPEED STABILITY. . . . . CK
Place auxiliary hydraulic pump ON. This is required for stabilizer movement.

Place captain and first officer's KIFIS test switches to TEST position.

Check for both altimeters increasing 350 plus or minus 50 feet. (Exception: If at an airport which is approximately 5000 feet in elevation, altimeters may not be within the required tolerance).

Release first officer's KIFIS test switch and observe altimeter returning to original indication.

Check for TAS indicating 496 plus or minus 5 knots.

Check for SAT indicating -80 plus or minus 1 degree.

Check for stabilizer position indicator increasing 1.6 degrees from previous indication. The speed stab fail light will illuminate momentarily until the stabilizer is repositioned. The stabilizer trim wheels should not rotate.

Release captain's KIFIS test switch and observe all instruments returning to original indications.

22. FLIGHT INSTRUMENT SELECTORS . . . . . ALL #1
Check for HOR GYRO switch being in the #1 position.

Check for FLT DIR COMMAND switch being in the #1 position.

Check for COMP SEL switch being in the #1 position.

Check for VOR switch being in the #1 position.

23. V_{mo} WARNING . . . . CK
Depress V_{mo} - M_{mo} WARN TEST button, checking for intermittent bell.

24. DRAG BRAKE LEVER . . . . . NORMAL DETENT
Check that lever is in NORMAL DETENT. If lever is not secure in detent, mechanical interference would occur when attempting to retract gear normally.

25. SPOILER SELECTOR . . . . NORMAL
Check that Spoiler Selector switch is in NORMAL position If necessary to reposition the switch to Normal, extend spoilers and have a crew member visually check that all spoilers extend equally. This assures that linear actuators are in the proper position. Return spoiler handle to DOWN detent after visual check.

26. SPOILERS . . . . DOWN
The handle should be full forward and pushed down into the detent.

27. AUTOPILOT . . . . CK & OFF
Yaw Damper Check
Place switch in YAW DAMPER position. Check for stiff rudder pedal action.
Return switch to OFF position. Check that rudder pedals now move freely. Check that autopilot flashing disengage light illuminates. Press to extinguish.

Autopilot Check
Place switch to AUTOPILOT position.
Operate turn controller and note proper turning response of control wheel.
Operate pitch wheel and note proper forward and aft movement of control column, and note movement of normal trim wheel.
Place Altitude Hold switch ON. Check pitch wheel being ineffective.
Depress captain's Autopilot disconnect button. Check autopilot has disengaged and controls are free. Disengage light will not illuminate.

28. FLIGHT DIRECTORS . . . . CK & SCAT
Flight Director Check
Select HDG mode on both mode selectors. Center HDG cursors on lubber lines. Turn each HDG cursor to left and right of lubber line and observe command bars indicating proper commands.
Rotate Pitch Trim Command knobs and check for climb and descent commands.
Place ALT HOLD switches ON. Check for pitch trim command being ineffective.
Place the FLT DIR COMMAND switch to the #2 position.
Check both command bars indicating same angle of bank when the first officer turns his HDG knob.
Each flight director will be disengaged by depressing respective autopilot disconnect button. Mode selector will trip to SCAT mode.

SCAT and Autothrust Check
Check for slow-fast flags out of view.
Slow-fast indicators will indicate slow.
Command bars will show same degree of fly down command.
Engage autothrust and throttles will move forward.
Depress autopilot disconnect button and throttle movement will stop. The autothrust flashing light will illuminate.
Return throttles to closed position and press light to extinguish.

29. STABILIZER CONTROL. . . . . . . CK & NORMAL
Place stabilizer trim hydraulic shutoff switch to CLOSE. Check that stabilizer will not operate when a normal trim wheel is actuated by hand rotation.

BEFORE STARTING ENGINES CHECK LIST AMPLIFICATION

PILOTS

Hold Electric Standby Stabilizer Control switch to NOSE UP and check that the emergency trim wheels rotate in the proper direction. Confirm stabilizer movement by observing position indicators. The normal trim wheels will move in the same direction as the emergency wheels when approximately one to two units of stabilizer movement has occurred. Check for proper NOSE DOWN stabilizer operation in the same manner. During these checks, normal operation of the standby motor clutch is indicated by almost immediate stopping of the emergency trim wheels when the switch is released, accompanied by an audible coast down of the motor.

CAUTION
Do not operate to either extreme of travel with the electric standby system to prevent damage to the trim actuator.

Return stabilizer hydraulic shutoff switch to OPEN.

Check captain's and first officer's aileron wheel thumb switches in each direction. Confirm proper stabilizer movement by observing normal trim wheels and stabilizer position indicators.

CAUTION
Use thumb switches only to the extent necessary to confirm their normal operation. Refrain from large stabilizer movements or continuous thumb switch use when auxiliary pump is the only source of hydraulic pressure, due to insufficient hydraulic volume.

). TRIM TABS . . . . CK
Check aileron and rudder trim tab for freedom and align aileron and rudder trim indicators to 0. (R-O-L)

.. EMERGENCY GEAR RELEASES . . . . STOWED
Check that both nose and main releases are flush with the pedestal rear surface.

!. ESSENTIAL BUS SELECTOR . . . . EXTERNAL POWER
The Pilots Essential bus is being powered by the ground power unit through the Sync bus.

}. ISOLATION SWITCHES . . . . AUTO
This allows the isolation valves to open and provide starting air for engines 1 and 2 when the bleed air manifold is pressurized.

. ENGINE & WING ANTI-ICE . . . . CK & OFF
Place all engine anti-ice switches to ON position Check that malfunct lights come ON. Return switches to OFF position.

If any malfunct light is on with switch off it indicates the front frame pressure switch is in the Pressure on position.

Place wing anti-ice switch to the ON position. If bleed air manifold is not pressurized, the six wing anti-ice valve closed lights will come on steady. If manifold is pressurized, lights should come on momentarily then go out. Wing anti-ice switch must be off for engine starting.

The blue anti-ice on light will be on when any engine anti-ice switch or the wing anti-ice switch is on.

35. IGNITION SEL . . . . BOTH
Confirm ignition selector switch in BOTH position, utilized during all normal system operation.

36. NO SMOKING . . . . ON
Place switch to NO SMOKING position to illuminate No Smoking, Return to Cabin and Fasten Seat Belt signs in cabin.

37. ANTI-SKID . . . . CHECK & ON

Push-to-Test all indicator lights.

Check Main system.

Place anti-skid switch OFF. Check for main inoperative light ON, after approx. 3 second delay.
Place anti-skid switch ON. Check main inoperative light goes out .

Check Nose system.

Check nose brake deactivation switch NORMAL.
PULL nose Anti-Skid control circuit breaker C-8.
Check nose inoperative warning light comes on.
Reset circuit breaker. Check nose inoperative light goes out .

38. WARNING LIGHTS .CK
Place warning light test switch to either BRIGHT or DIM and check:

All rectangular or square warning lights will illuminate except:

Autopilot disconnect
Radio altimeter MDA

No round warning lights will illuminate.

39. OXYGEN MASK AND REGULATOR . . . . . . .CK & SET

Check Mask

Remove mask from its quick release strap.
Check connection of oxygen hose and microphone cord.

Check Emergency Oxygen

Place supply lever to ON, diluter lever to 100% and emergency lever to EMERGENCY while holding mask away from face. Note indication of continuous oxygen flow.
Place emergency lever to NORMAL.

Don Mask
Adjust oxygen mask for a tight fit by use of index numbers and letters. Make certain the mask provides a secure leak-proof fit so that movement of the head while performing cockpit duties will not cause the hose to pull the mask away from the face.

Check 100% and Normal Oxygen

Check 100% with oxygen supply lever OFF. No air, oxygen or ambient, should be available if the air diaphragm in the regulator is intact.

An abrupt exhalation after initial inhaling may cause the mask exhaust valve to remain open. This is a normal condition when the mask hose is evacuated.
Check NORMAL with oxygen supply lever OFF. Ambient air should be available when inhaling, but no oxygen flow should be indicated.

BEFORE STARTING ENGINES CHECK LIST AMPLIFICATION

PILOTS

Check NORMAL with oxygen supply lever ON. Oxygen flow should be indicated when inhaling.
Check 100% with oxygen supply lever ON. Oxygen flow should be indicated when inhaling.

Leave oxygen supply ON, diluter lever 100% and emergency NORMAL.

Check Oxygen Mask Microphone
Place microphone selector to Interphone position, press oxygen mask microphone switch and check microphone output with headset or speaker.

Hang mask on quick-release strap with release end of strap on the inboard side of hanger assembly. Hang mask by both head straps.

Check that smoke goggles are available in their storage pouch.

ENGINEER

1. BATTERY . . . . NORMAL
   In this position the battery is:

   Connected to the charger.

   Not connected to either DC bus.

2. LOAD REDUCTION SWITCHES. . . . . CK & ON
   Place Load Reduction switches OFF and notice the respective amber lights glow. Return switches ON and note Load Reduction lights are out.

   NOTE
   If only main external plug is powered, both Load Reduction lights will be ON. After aircraft generators are powering systems, note that both Load Reduction lights go out.

3. OIL QUANTITY. CK
   Each engine is normally serviced to approximately 3 gallons, however, 2.5 gallons or more is satisfactory indicated quantity. If less than 2.5 gallons is indicated, the tank must be serviced to at least 2.5 gallons.

   The indicated quantities should be noted on the fuel log for future reference.

4. FUEL QUANTITY. . . . . LBS.
   Response to this should be brake release (Takeoff) fuel on board to provide a double check for the captain.

   Check the fuel quantity indicating system by placing fuel quantity selector switch to REPLENISH a few moments and release. Quantity should return to original indicated quantity.

5. FUEL PANEL. . . . . CK & SET
   Turn all boost and transfer pumps ON and check that all low pressure lights go out (transfer pump lights come ON momentarily then go out). Turn all pumps OFF. When ready to start engines, turn on both #1 boost pumps.

   NOTE
   With external power Main plug only supplying the aircraft, all pumps cannot be checked until after electrical system powered from aircraft generators.

   Check each line and crossfeed valve, by use of the transit light, for being open. This includes the emergency crossfeed valves since engine starting will be done with #1 tank fuel to purge the crossfeed lines of any trapped air.

   Check both De-fuel switches in CLOSED position and both indicator lights out.

6. AIR CONDITIONING PANEL. . . . . . CHECK & SET

   RECIRC FAN ON
   This provides air circulation for heating and cooling on the ground.

   FREON SELECTOR & PACK SWITCHES CK
   To start operation of the air conditioning systems on the ground, proceed as follows:

   With the FREON SELECTOR switch in BOTH ON position, place R. H. FREON PACK switch to ON.

   If only one ground power plug is connected or if the ground power unit is incapable of supplying two Freon systems, do not attempt to start the L. H. system until after engines are started.

   After approximately ten seconds, and if electrical power is sufficient, place the L. H. FREON PACK switch to ON.

   Freon packs must always be started one at a time to prevent over-loading the electrical system.

   TURBOCOMPRESSORS OFF
   Turbocompressor switches should be OFF to prevent the turbocompressors from starting when the bleed air manifold is pressurized.

   ALTERNATE PRESSURE SOURCES CLOSED
   Alternate pressure source switches should be in CLOSED to prevent engine bleed air from entering the air conditioning systems when the bleed air manifold is pressurized.

   TEMPERATURE CONTROLS . . . . AUTO & SET
   Set cabin and flight deck temperature controls at approximately the 11 o'clock position and the selector switches in AUTO.

   TEMP INDICATOR SEL. . . . . DUCT

   DUCT TEMP SEL. . . . . L. H. EVAP AIR IN
   This permits monitoring the left turbocompressor air temperature during takeoff since it is normally being used.

7. PRESSURIZATION CONTROLS . . . . . AUTO & SET
   Set the pressurization controls as follows:

   Pressure Regulator switches - AUTO
   Both Pressure Regulator CLOSED lights should be out.

   Cabin Altimeter - Set to local barometric pressure.

   Cabin Altitude Selector - Set Cabin Altitude pointer 500' above field elevation. Check Flight Altitude indication in window; if below planned cruise altitude, select Flight Altitude indication to approximately 2000' above desired cruise altitude. Adjust Barometric Corrections Scale to local barometric pressure.

   Rate Knob - Adjust just out of DEC position.

8. EQUIPMENT COOLING. . . . . FAN ON
   Since takeoff will normally be made using one turbocompressor, the equipment cooling fan is to be left on until the second turbocompressor is operating.

BEFORE STARTING ENGINES CHECK LIST AMPLIFICATION (Cont'd.)

ENGINEER

9. HYDRAULIC QUANTITY . . . . CK
With the hydraulic system pressurized the minimum readings should be 1.0 gallons for #1 system, and 3.2 gallons for #2 system.

10. OXYGEN SYSTEM . . . . ON & CK

Check that passenger/crew interconnect valve is closed and both manual override handles are horizontal prior to opening any passenger bottle.

Check that all crew and observer regulators have their emergency levers in the NORMAL position and that the observer regulator supply lever is OFF prior to opening the crew bottle.

Slowly open all oxygen bottle valves fully, then return 1/2 turn toward closed.

Check that passenger and crew system pressure is at or above minimum.

11. CIRCUIT BREAKERS AND LIMITERS. . . . . CK
All circuit breakers on the 298 bulkhead should be in except:

Breakers that are banded open due to de-activated systems or provisional installations.

ESSENTIAL OVERRIDE CB switches on "C" panel. These are ON only when the ON position of the Essential Radio switch does not supply power to its radio units and electrical power is on the pilot's Essential AC and Emergency DC busses.

The current limiters and circuit breakers below the 298 circuit breaker panels and the engineer's desk, should be checked and any discrepancies corrected.

12. DC POWER . . . . CK
With external power ON, all AC load busses powered and all T-R switches On, check the DC system as follows:

Place battery switch to EMER. Note charger relay light ON, battery amperage indicates between zero and a "+" amperage depending on battery condition and that T-R amperages feeding the Emergency bus are different than T-R amperages feeding Essential bus. Both BUS OFF lights should be out.

Place battery switch to NORMAL and note that charger relay light blinks and goes out, battery amperage between zero and -2 to -10. A battery that continues to accept a -10 amp charge rate for longer than thirty minutes should be written up as faulty.

Place #1, #2, and #3 T-R switches OFF and note that #4 T-R voltage is within limits. An abnormally low voltage will indicate a blown fuse in the AC power lead to the T-R. Place #3 T-R ON and #4 T-R OFF and check #3 as previously described for #4. Repeat with remaining T-R's.

NOTE

With only the Main external power plug installed, #1 T-R cannot be checked until generators are feeding the electrical system.

Return all T-R switches to ON and Voltmeter Selector to Battery position. Note that all T-R amperages are normal. This confirms the T-R switch positions and amperage output after the DC power check.

13. 26V POWER . . . . CK & ON MAIN

Prior to performing this check:

Check that the gear handle is down and the flap handle is synchronized with indicated flap position.
Place Cabin Freon switch OFF.
Place Aux Hydraulic pump ON and check system pressure.
Check MAIN and STANDBY indicator lights, and that the selector switch is in the MAIN position.

To check the integrity of the manual and automatic 26V and 115V power transfer system:

Open #3 bus tie relay. MAIN OUT light will be illuminated.

Place the selector switch to STANDBY and check:

#1 and #2 hydraulic system pressure dropping toward or at zero.

GYRO flags not visible.

COMPASS flag is not visible on captain's FPI.

COMPASS flag is visible on the F/O's FPI.

Select any generator position with the Pilots Ess Bus selector.

Both GYRO and COMPASS flags will appear.

All EGT OFF flags will appear.

STANDBY OUT light will illuminate.

To check the operation of the Emergency Static Inverter:

Place Inverter switch ON.

EMERG IGN POWER ON light will illuminate

EGT OFF flags will retract from view.

Return switch to OFF AND RESET.

Inverter light will go out.

EGT OFF flags will re-appear.

To restore normal operation:

Place selector switch to MAIN
Close #3 bus tie relay.
F/O's COMPASS flag and both GYRO flags will retract from view.
#1 and #2 hydraulic pressure will increase to original pressure.
Place the Pilot's Ess Bus selector to EXT POWER position.
Captain's COMPASS flag will not be visible.

14. EMERGENCY INVERTER . . . . OFF
Check that Inverter switch is in Reset and Off position and indicator light is out.

15. GENERATOR CONTROLS . . . . CK
The Field switches should normally be ON. The Bus Tie and Line switches should be in the CLOSED position.

C. **BEFORE STARTING ENGINES CHECK LIST AMPLIFICATION**

FLIGHT ENGINEER

16. JETTISON AND SCAVENGE SWITCHES . . . CLOSED

17. ALT PRESS SOURCES . . . CLOSED
These valves must be closed during all ground operations except for the purpose of checking their operation.

18. TURBOCOMPRESSORS . . . OFF
Keep turbocompressors off until after engine starting to conserve starting air.

19. ENG HYDRAULIC PUMPS . . . ON
Check that all pump switches are ON. Pump failure can occur if switch is in Inlet Closed position and engines are started.

20. OXYGEN MASK AND REGULATOR . . . CHECK & SET
Perform necessary checks and set oxygen regulator as described in Amplification of Pilot's Before Starting Engine Check List, this Section.

21. GEAR PINS . . . REMOVED
The flight engineer will note on pre-flight if the gear pins are removed. If gear pins were installed, the flight engineer must advise the captain so that he may confirm their removal by interphone contact with the ground crew before starting engines.

* * *

ENGINE STARTING

Do not start engines until:

Pilots and engineer are at their stations.

The Before Starting Engines check list has been read.

Ground crew has given clearance to start, and designated which engine is to be started.

When ready to start engines, contact the ground and advise "Ready to start engines, pressurize the manifold."

If the auxiliary hydraulic pump is inoperative, engine No. 3 or No. 4 must be started first. This will provide hydraulic pressure from the No. 2 hydraulic system for main gear brakes.

If one or more start valve open lights are inoperative, refer to section 04.01 for starting procedure with start valve open lights inoperative.

If no ground electrical power is available, refer to section 04.01 for starting procedure.

The engineer will place the following switches off just prior to the ground personnel pressurizing the bleed air manifold for engine starting:

Both Freon packs.

#1 load reduction.

Place beacon light switch ON. Leave beacon lights on for the rest of the flight.

Captain commands first officer, "Turn ______". Hold start switch to GROUND START.

Should the start switch be inadvertently released prior to reaching 47%, do not re-engage starter until engine has stopped rotation or starter damage will result.

If a hot or hung start is indicated after the start switch was prematurely released, place the start lever OFF and allow the engine to stop rotating before trying another start.

If no indication of engine rotation in 10 seconds, release start switch to OFF. Check that start cart air is available, and start valves and ignition control circuit breakers are in.

This starting procedure is the recommended normal engine starting procedure under all conditions:

Place start lever to RUN detent.

Hold start switch to GROUND.

Be prepared to terminate the start immediately in the event of an abnormally rapid EGT rise.

Release the start switch to OFF when the engine reaches 47%. Continue to monitor EGT and fuel flow until the engine reaches idle.

Move start lever to OFF immediately if:

EGT does not rise within 20 seconds of initial fuel flow.

EGT reaches 550°C.

No indication of oil pressure rise in 30 seconds.

If the start is aborted prior to 47% continue to hold start switch for 20 seconds to clear engine. If start switch is released do not re-engage starter until engine has stopped rotation.

If start is aborted above 47% compressor deceleration will adequately clear engine. Do not re-engage starter until engine has stopped rotation.

The first officer will release start switch when engine reaches 47% RPM and is accelerating normally with normal EGT indication.

If an engine fails to reach idle RPM and indicates a hung start condition, take the following steps immediately:

If engine RPM is <u>below 47%</u> leave start switch in GROUND position and move start lever to OFF momentarily then back to RUN.

If engine RPM is <u>above 47%</u>, hold start switch to FLIGHT position and move start lever to OFF momentarily then back to RUN.

As each engine is started, the pilot will advise the ground man "Turning No. ____" and the engineer will:

Observe first indication of engine oil pressure. If no indication 30 seconds after rotation started, advise captain "No oil pressure # ____ engine." Engine must be shut down immediately.

Record time of engine starting on fuel log.

Starting EGT limits:

If EGT exceeds the starting Type 1 limit, record the peak EGT observed and the time the EGT was above the starting limit.

If an engine exceeds a Type 2 condition during starting, shut the engine down.

Use same technique when starting remaining engines, in the order cleared by ground personnel.

The engineer will monitor start valve open warning lights and generator indications for normal response as each engine reaches idle RPM and advise the captain of any abnormal condition. If the CSD drive malfunction light has not gone out by the time the engine reaches idle speed, the engine must be shut down or the Drive Malfunction procedure followed.

After two generators have assumed their load bus the engineer will change electrical power from ground to aircraft source.

CAUTION

Do not transfer electrical power while a start switch is held to ground position. This is to prevent interruption of start control power and possible starter drive failure.

If No. 2 or No. 3 TR is inoperative, see chapter 05.01 for Alternate Power Change procedure.

Move external power switch momentarily to PARALLEL position and release.

Observe that bus ties for all inoperative generator busses close and that operating generator(s) bus ties close as autoparallel limits are reached.

Advise the captain "Electrical power changed over."

When two generators are in parallel, return No. 1 load reduction switch to ON.

NGINE STARTING (Cont'd.)

After electrical power has been changed over, the captain should request that the electrical cart be removed.

When three generators are operating in parallel, one freon pack may be started if necessary to maintain passenger comfort.

hen all engines are successfully started and the ramp gnal man is in sight, the captain will advise the ground rew, "Remove all ground equipment and disconnect interone".

he door lights must be out prior to taxiing away from the amp.

ATE PUSH-OUT PROCEDURE

hen a gate push-out procedure is used, any or all engines eed not be started until push-out is completed provided the rea behind the aircraft is clear. Should taxi requirements ctate that one engine would be shutdown for taxiing, that gine need not be started until the aircraft is in number ree position for takeoff as prescribed in taxi procedures.

RIOR TO MOVING:

The captain must be in interphone contact with ground personnel.

Before Starting Engine check list completed.

Hydraulic pressure normal.

Reduce the electrical loads prior to connecting the tow tractor External AC power to the aircraft. For air conditioning, use only the recirculating fan because of the limited electrical power available.

When engines not running, place battery switch to EMERGENCY position.

HEN READY TO MOVE:

Ground personnel will advise "Ready to tow" when they are ready to move the aircraft.

The captain will signify he is ready by advising "Brakes off". This means:

The signal man is in sight and the ramp agent's salute has been returned.
Ground control clearance has been received to leave the gate.
The brakes have been released.

Should the captain want the aircraft stopped for any reason, such as a request from ground control, loss of external power, etc., he shall advise the ground personnel by interphone to "Stop the aircraft". Avoid using the aircraft brakes for stopping without first advising ground personnel, as they are responsible for the aircraft speed, directional control and obstacle clearance while the aircraft is being towed.

When towing is complete, ground personnel will advise "Park the brakes." After the brakes are parked, the captain will advise the ground personnel "Brakes parked."

ENGINE STARTING AFTER PUSH-OUT

When ground personnel advise "Clear to start engines," this signifies they have:

Disconnected the tow bar.

Reconnected the nose gear linkage.

Removed the gear pins.

Connected external air pressure.

Use normal engine starting and taxi procedures.

ENGINE STARTING PRIOR TO PUSH-OUT

When the engines have been started and the After Starting Engines check list has been completed, the captain will signify he is ready by advising ground personnel "Brakes off" and then release the brakes.

When push-out is completed, ground personnel will advise the captain "Nose gear scissors connected and pins removed" when they have:

Disconnected the tow bar.

Reconnected the nose gear linkage.

Removed the gear pins.

When the captain has the ground signal man in view he will advise the ground personnel "Disconnect interphone". Use normal taxi procedures.

AFTER STARTING ENGINES CHECK LIST AMPLICIATION

The Captain should accomplish the Essential Power and Isolation Valve checks before calling for this portion of the check list.

1. ESSENTIAL BUS SELECTOR . . . CK - ON EXT PWR.

   Select each operating generator to insure the availability of Pilot's essential A. C. power from each as indicated by the Essential Bus Fail light on the Captain's instrument panel.

   Return selector to External Power to connect the Pilot's Essential A. C. bus to the sync bus.

2. EXCESS HEAT AND ISOLATION. . . . . CK & AUTO

   With engines at idle the engine bleed valve CLOSED indicator lights may go out or cycle on and off. At this time the bleed valves are supplying air to the EPR inlet probes.

   Place excess heat test switch to TEST momentarily and note:

   All three Excess Heat Warning lights come ON.
   All four Engine Bleed CLOSED lights come ON.

   Cycle right Wing Isolation Switch OFF and back to AUTO. Right wing Excess Heat light should go out (remaining two stay on) and #3 and #4 engine bleed valve CLOSED lights go out.

   Repeat step "c" for left wing isolation switch.

   Place Rain Clear ON and note ON light stays out.

   Cycle fuselage isolation switch to OFF and back to AUTO. Note that fuselage excess heat light goes out and the rain clear light comes ON.

   Place L. H. bleed valve switches to close. When lights come on, note that rain clear continues to operate. If rain clear stops, opposite isolation valve is closed. Return bleed valve switches to open.

   Repeat with R. H. bleed valves.

   Place rain clear switch OFF and note its light goes out.

3. BEACON LIGHTS . . . . ON
   Beacon lights should be on before starting and remain on while any engine is running.

4. DOOR LIGHTS . . . . CHECK
   The door lights must be out prior to taxiing away from the ramp.

5. START LEVER. . . . . CHECK
   Be sure start levers are in the run detent to prevent inadvertent creeping toward off.

6. FLIGHT CONTROLS . . . . CK

   Check for freedom of movement of rudder pedals and elevator yoke. Should crosswind or tailwind create doubt as to normal control reaction, a re-check may be performed at some convenient point in the taxi-out where a headwind exists.

   Rotate aileron wheel full travel in each direction, noting #1 and #2 hydraulic system pressure fluctuations. At full travel in each direction, release the wheel and note that it centers itself smoothly and rapidly.

   NOTE
   On aircraft with "Spoiler Control Overload" lights installed, if a momentary or steady illumination of either of these lights is observed during this check, the spoiler control system must be corrected prior to flight. Should either light illuminate while in flight, closely monitor lateral control response and continue flight to destination.

   Failure of the wheel to return itself to neutral or if the wheel returns sluggishly when released indicates excessive binding. Should binding occur, a maintenance check of the spoiler control system is required.

   When this check is made from the First Officer position, be alert for a rapid spring-back caused by compression/extension of the spring interconnect tube. Wind load on the ailerons may require that the check be done from the Captain's position should interconnect spring tension be less than the force required to move the ailerons.

   Each pilot should be sure his seat is properly set and locked fore and aft to assure full rudder application capability.

FLIGHT ENGINEER

1. FLT. RECORDER. . . . . ON
   Moving the circuit breaker switch (panel C) to its Up position starts the recorder.

2. FUEL PUMPS. . . . . MAINS ON
   Place all main transfer and boost pumps ON for taxi, takeoff, climb, and initial cruise operations.

   CAUTION
   If aircraft fueled from top of wing, see FUELING Procedures, Section 02. 08, for takeoff limitations.

   If all boost and transfer pumps could not be checked prior to starting engines, they should be checked at this time.

3. CROSSFEED VALVES . . . . CLOSED
   Restore tank-to-engine configuration.

AFTER STARTING ENGINES CHECK LIST AMPLIFICATION

4. ELECTRICAL POWER . . . . CK

Check TR ammeters for approximately equal output indications.

Check battery ammeter for charging rate. A continuous indication of -10 amps is evidence of a low battery. Time required to restore battery to full charge will vary up to thirty minutes. A battery that continues to accept a -10 amp charge rate, for a longer period than thirty minutes should be written up as faulty.

Check generator ammeters for approximately equal load division.

5. AUXILIARY HYDRAULIC PUMP . . . . OFF
Place auxiliary pump switch to OFF, which also closes the interconnect shutoff valve, to provide isolation of hydraulic systems.

* * *

LEAVING RAMP

When the ramp clearance salute is received and acknowledged, release brakes and begin taxi.

WING FLAPS

After clearing the ramp, the wing flaps should be started down to the 20° position.

While flaps are traveling to 20°, hold flap asymmetry test switch to TEST. Confirm that flaps stop until test switch is released.

THREE ENGINE TAXI

Consider the following procedure when an extensively delayed takeoff is expected:

Place the auxiliary hydraulic pump switch on.

Shutdown the No. 3 engine.

Manage the fuel system to maintain lateral balance.

When in number three position for takeoff:

Restart No. 3 engine. Take into consideration any aircraft behind.

Place the auxiliary hydraulic pump OFF.

Complete the After Starting and Taxi check lists.

The above procedure is not to be used unless the generators on engines 1, 2 and 4 are operating normally.

MANEUVERING

Maneuvering the aircraft on the ground is accomplished in most respects similarly to other conventional tricycle geared aircraft. Nose wheel steering and engine thrust as required, either symmetrically or asymmetrically, are normally used for taxiing. Differential braking is also effective as an aid in taxiing.

Always use the largest radius of turn possible and never attempt to turn until the aircraft is moving. Also, avoid using the brakes on the inboard gear truck. These techniques will prevent nose wheel scrubbing and overstressing the main gear trucks.

In the event of hydraulic failure while taxiing, the emergency air brakes and engine reversers can be used for stopping the aircraft. Reverse thrust is not to be used for backing or maneuvering during taxi or parking.

Because of the swept wings, the wing tips must be watched carefully for clearance of equipment on the ramp, especially while making turns.

A white mark is painted on the nose steering wheel hub at the 56° right turn position. Turns should normally be limited to 56° during parking, except when using the guide light system for Jetways. To properly park aircraft at Jetways it is necessary to rotate the nose steering wheel full travel, then back off slightly, to avoid overshooting desired radius.

Watch for and avoid, if possible, loose gravel, etc., while taxiing, especially where the engines are not over the taxi strip proper, to minimize the possibility of engine foreign ingestion damage.

Effort should be made to use symmetrical power on all four engines during taxi. If an outboard is used to assist in turns, use as little power as possible and do not allow aircraft to stop while using high power unless over a clear area.

ENGINE FUEL TEMPERATURE

Select each engine position with the temperature selector and check for abnormally hot engine fuel temp, indicating a partially open fuel heater valve. Engine fuel temperatures below approx. zero (0°)C indicate a malfunctioning fuel heater.

WING LEADING EDGE AND DUCT SPACE TEMPERATURE

If a functional check of the wing anti-icing system has been made, check positions 1 through 6 of the leading edge and duct space temperature selector. Check for abnormally high temperature. Return selector to position 7 or 18 to monitor the largest portion of the wing.

PRESSURIZATION SYSTEM

As soon as possible after leaving the ramp, check all four cabin pressure sources for operation. Turn each source on and observe RPM or airflow change. Do not use alternate pressure source on the ground except for operational check.

If engine exhaust fumes are evident at any time turbocompressors are being used, turn the turbocompressors off until cleared for takeoff.

TAKEOFF PERFORMANCE

Determine the maximum allowable gross weight for the existing runway conditions, and also V_1, V_r and V_2 for the actual takeoff gross weight. If calculated V_r or V_1 is less than V_{mcg} increase them to V_{mcg}.

Since the depth of water or slush on the runway to be used for takeoff can materially affect the takeoff performance, consult chapter 15 for possible weight restrictions.

STABILIZER TRIM SETTING

The engineer will use the stabilizer trim computer to compute the proper stabilizer trim setting for takeoff. If computer not on board, use chart in chapter 15, this handbook.

TAXI CHECK LIST AMPLIFICATION

PILOTS

1. FLAPS . . . . .INDICATE 20°
   Normal takeoff position is an indicated 20° of flap extension.

   Crosscheck the indicator against the selected handle position. If the indicator shows two needles prominently or stops prior to reaching the selected position, a malfunction may have caused the flap asymmetry protection system to shut off the flaps.

WARNING

IF A SPLIT OR ASYMMETRICAL FLAP CONDITION IS INDICATED. RETURN TO RAMP AND INVESTIGATE. DO NOT OPEN THE FLAP ASYMMETRICAL CONTROL CB IN FLIGHT.

.XI CHECK LIST AMPLIFICATION (Cont'd.)

PILOTS

SCAT . . . . CK
After takeoff flaps are set, the slow-fast pointers will move to a fast position. The command bars will give a fly-up command while in the SCAT mode. When accelerating, the slow-fast pointers will move further in the fast position and the command bars will give an increasing fly-up command. When the aircraft slows, the slow-fast pointers will move toward the slow position, and the command bars will move toward the fly-down indication.

SCAT must be checked during taxi. Use of SCAT for takeoff is SCD.

. PITOT HEATERS . . . . ON
Both pilot and co-pilot pitot heat switches shall be turned to the on position.

. ENGINE ANTI-ICE . . . . __ ______
The engine anti-ice system will normally be left in the off position. The system shall be turned on for takeoff if the OAT is below 41°F and visible moisture is present. Visible moisture is fog (one mile visibility or less), or rain, or drizzle, or wet snow.

. STABILIZER TRIM. . . . . SET & CROSSCK
The stabilizer should be set to the position indicated by the trim computer or stabilizer trim chart.

After the stabilizer is set, the captain should cross check the setting on both the pedestal and the instrument panel stabilizer position indicators.

. TAKEOFF DATA/AIRSPEED BUGS . . .SET & CROSSCK
Confirm that correct V_1, V_r, and V_2 are entered on the takeoff data card. Set the bug on each airspeed indicator to V_2 and crosscheck the settings.

If takeoff weight is less than the lowest published value, (chart or placard), use the V_2 for the lowest weight shown and check against V_{2min}.

Check each EPR bug at EPR value obtained from the takeoff thrust setting chart.

If any water or slush is standing on runway, observe appropriate restrictions.

BEFORE TAKEOFF AMPLIFICATION

PILOTS

1. CABIN ALERT .CK
Prior to takeoff, the cabin attendants must be notified of the impending takeoff by either a PA announcement or the four chime signal. A brief PA announcement is recommended. "All flight attendants please be seated."

2. TRANSPONDER . . . . CK
Place transponder switch as directed by ATC.

3. IGNITION . . . . FLIGHT START
Place start switches to FLIGHT position for takeoff. Keep ground use of ignition to a minimum as igniter life is affected.

ENGINEER

1. TURBOCOMPRESSORS . . . . .CHECK
Unless abnormal conditions exist in the air conditioning systems, the left turbocompressor is recommended for takeoff.

Use only one turbocompressor for takeoff unless maintaining a warm cabin is a problem. Two turbocompressors may be used provided the recirculation fan is turned off and the equipment cooling switch is placed to valve open prior to takeoff.

* * *

COCKPIT CHAIR POSITIONS FOR TAKEOFF

The captain and first officer shall be certain their chairs are set and locked in a position which allows full rudder and brake application and are expected to remain in this position during the critical stages of takeoff, climb, approach and landing.

CABIN PRESSURIZATION

Bleed air for pressurization (alternate pressure source) may be used in flight at any time provided evaporator air in temperature does not exceed 140°F. Do not use alternate pressure source during takeoff or initial climb thrust application because of the probability of exceeding this temperature limit.

TAKEOFF TECHNIQUE CONSIDERATIONS

The following considerations are part of each takeoff procedure:

The EPR bug should be set to chart takeoff EPR value prior to takeoff. If the settable EPR bug is inoperative on any EPR indicator, refer to Alternate Takeoff Procedures paragraph this section.

When rain clear is on for takeoff, only one turbocompressor, preferably the left, can be on for takeoff until rain clear is off or until reaching 400 feet above the field, whichever occurs first.

The prime instrument to be used for controlling engine thrust level and thrust limits is EPR. In those cases where an EPR indicator becomes inoperative or is obviously in error, only the RPM shall be used for this purpose and a log notation made. The necessary target RPM may be derived either from an average of the other operative RPM indicators or from the appropriate chart.

The RPM values, listed on the thrust charts, are "expected to see" values and not limiting. The RPM limits requiring action are listed under type 1 Engine Limits in section 02.75.

EGT and fuel flow are primarily for indicating engine condition and to provide instrumentation crosschecks. They are not to be used as the basic reference for making thrust settings.

In those cases where an EPR gauge becomes inoperative or is obviously in error after brake release, ascertain that engine RPM is at least as high as the highest of the other three engines, F/F is at least as high as the lowest of the other three engines and EGT is within limits for takeoff.

If an EPR indicator is inoperative prior to brake release refer to Alternate Takeoff Procedures paragraph this section.

Once the target EPR is set, no readjustment is required during the takeoff segment. Any increase that occurs because of acceleration shall be maintained except to avoid exceeding EGT or RPM limits. If exceeded, retard throttle until within limits, flight conditions permitting, and note time above limit and peak indication in the aircraft logbook.

The landing gear warning horn will sound intermittently when throttles are advanced beyond the 92% RPM position if:

- Speed brake handle is not fully forward (0° detent).
- Flaps are not between 17° - 23° range.
- Stabilizer is not in takeoff range. (1.5° - 7° nose up).
- Any spoiler selector actuator not in normal position.

CAUTION

→ The takeoff warning horn system will not function properly under lower ambient temperature conditions where takeoff EPR is achieved prior to reaching an RPM of 92%.

During the takeoff roll, the first officer should maintain a forward pressure on the yoke while the captain is using nose wheel steering during the initial roll. This will keep the nose wheel firmly on the ground so as to prevent excess yaw in the event of an engine failure.prior to rotation.

Care should be exercised in the use of lateral control during a crosswind takeoff. Excessive aileron application will cause a significant differential spoiler extension which induces spoiler yaw. Overcontrolling, when compensating for spoiler yaw, may result in lateral oscillations at takeoff. Therefore, apply only the amount of aileron necessary in a steady and positive manner.

During the takeoff roll, the first officer and engineer must scan the engine instruments. Whenever an engine indicates an abnormal condition that will significantly affect its thrust output, advise the captain "engine failure." The captain can then take the appropriate action.

Aircraft performance will suffer if rotation is started too soon or too late. Rotating too early will cause an unnecessary increase in drag which will increase the runway used and may cause the aircraft to leave the ground prematurely with the resultant sacrifice in climb out performance. On the other hand, breaking ground too late, will result in a climb out penalty.

After lift off, do not make large attitude changes to gain airspeed as sinking will result.

Braking is automatically applied to all wheels during the period of time that the landing gear is retracting.

MINIMUM SPEEDS

After takeoff, the minimum speed for initial climb is V_2. Flaps may be retracted after reaching 800 feet and attaining speed of V_2 + 30 KTS. Turns must be restricted to a maximum of 15° bank until the aircraft has accelerated to minimum maneuvering speed.

The minimum speed for maneuvering is determined by adding one knot to V_2/V_{ref} for each degree of flap less than 50°. For example, with 30° flap the minimum maneuvering speed is V_2/V_{ref} + 20 KTS. Minimum maneuvering speeds provide a safe margin above stall for bank angles up to 40°.

TAKEOFF

While turning into position, smoothly advance the throttles so that engine RPM is above the slow acceleration range as runway alignment is attained. Check engine instruments for abnormal conditions.

Continue advancing throttles smoothly until reaching slightly less than takeoff EPR. Command first officer to trim throttles. The first officer will trim throttles so as to have EPR set between 40 and 80 knots.

If cleared for takeoff when already in position, advance the throttles above the slow acceleration range, check engine instruments and then smoothly release the brakes.

Use nose wheel steering to approximately 80 knots, then control direction with rudder. The first officer should call out 80 knots as it is attained.

The captain shall keep his hand on the throttles until the aircraft is committed for takeoff.

The first officer shall call out V_1 and V_r as they are reached.

KEOFF (Cont'd)

rotation speed, rotate smoothly to initial climb attitude. Avoid id or abrupt attitude changes.

ircraft fails to rotate after a greater than normal elevator k-pressure is applied, use nose up stabilizer trim to effect ation. (If stabilizer trim is initially set near the nose up it, additional application of trim before the aircraft leaves ground may result in the intermittent warning horn sounding.)

ring takeoff roll, immediate attention should be given to any normal conditions which would indicate the desirability of re-ting the takeoff as a precautionary measure. If at all possible, decision should be reached before attaining high speed.

jecting a takeoff at high speed is a critical maneuver. Once decision has been made to reject a takeoff, it is mandatory t the reject procedure be strictly adhered to without delay.

e Rejected Takeoff procedure is found in chapter 3, this ndbook. Technical information relative to a rejected takeoff be found in chapter 6 of the Flight Operations Policy Manual.

n engine failure occurs after V_1, continue the takeoff using rmal technique. Maintain directional control by alert and gressive use of rudder. Some aileron control may be required.

tract landing gear when airborne with a positive rate of climb l at V_2. A positive rate of climb is shown by a sustained mb indication and verified by a continuing increase in altitude.

en the landing gear indicates up, engage the yaw damper.

RMAL TAKEOFF

e normal takeoff procedure for all runways except when specific se abatement procedures are listed in the approach chart ction of the Operations (Jeppesen) Manual.

intain takeoff flaps and thrust, with a speed of V_2 + 10 knots, il reaching 3,000 feet above the airport. If, at 15 degree ch attitude, the airspeed increases to normal flap retraction eed, flap retraction may be initiated above 800 feet.

a turn is required, limit bank angle to 15°, if speed is less n minimum maneuvering. Begin turn as soon as practicable, nsistent with safety.

duction to not less than climb thrust may be made at 1,500 t or above. Light weight aircraft may require further thrust duction to stay within maximum speed restrictions. Takeoff rust may be maintained until reaching 3,000 feet if engine nitations permit.

a minimum of V_2 + 30 knots and accelerating, retract flaps.

flaps have not been retracted prior to 3,000 feet, increase eed and retract them at this time.

ntinue acceleration to desired climb speed using moderate mb attitude. Reduce thrust as necessary to stay within ximum speed restrictions. Command first officer or engineer set climb thrust when appropriate.

EN USING SCAT

e standard takeoff procedure. During takeoff roll acceleration, te that both command bars indicate a fly-up command.

Use normal rotation technique at V_r. The command bars will provide climbout attitude target reference for a minimum of V_2. (Maximum pitch command is limited to 15 degrees, although HDI could read slightly higher). Crosscheck HDI indication and indicated airspeed.

If engine failure occurs or thrust reduction is required, SCAT will continue to provide commands for optimum performance.

If a wing low condition occurs after takeoff, SCAT will provide roll commands to maintain wings level.

Place both flight directors off, or to another desired mode, when starting acceleration for flap retraction.

ENGINE FAILURE AFTER V_1

Normal liftoff attitude will result in attaining V_2 at 35 feet above the runway. Maintain V_2 until 800 feet, but not to exceed 15 degree pitch attitude. At light weights, accept an airspeed increase while maintaining 15 degrees pitch.

At 800 feet, maintain zero rate of climb while accelerating. Retract flaps on normal retraction schedule and accelerate to V_2 + 50 knots.

Climb to 1,500 feet at V_2 + 50 knots but do not exceed 15 degrees pitch attitude.

FIRST OFFICER TAKEOFF

If the conditions outlined in chapter 3, of the Flight Operations Policy Manual are met, the captain may let the first officer make the takeoff. When the first officer is making the takeoff, those normal takeoff procedures covered under the previous Section will be followed except as modified below:

The captain will initiate the setting of takeoff thrust and keep his hand on the throttles until the aircraft is airborne and a positive rate of climb and normal climb-out attitude have been established. At this point, he will indicate that the first officer is to assume control of the throttles by commanding "Your Throttles."

The first officer will trim takeoff thrust, and call out when reaching 80 knots.

At 80 knots, the first officer will assume directional control with the rudder.

The captain will call V_1 and V_R as these speeds are reached on the takeoff roll.

ALTERNATE TAKEOFF

INOPERATIVE EPR ADJUSTABLE INDEX (BUG)
If any EPR bug is inoperative, the normal takeoff procedure must be modified as follows:

When clearance is received for takeoff, taxi into position for takeoff and park the brakes.

Advance throttles smoothly to takeoff EPR. Crosscheck engine instrumentation for any abnormal indications. Maximum EGT is 632°C for brake release.

Slowly release brakes so as to minimize the pitch up effect. Remainder of the takeoff procedures and techniques are the same as for a normal takeoff.

ALTERNATE TAKEOFF (Cont'd)

INOPERATIVE EPR INDICATOR
If the EPR indicator is inoperative for an engine, the normal takeoff procedure must be modified as follows:

When clearance is received for takeoff, taxi into position and park the brakes.

Advance throttles on the operative EPR system engines to target EPR.
Advance the throttle for the engine with an inoperative EPR indicator until the:

RPM - No lower than the highest of the other 3 engines.
Fuel Flow - No lower than the lowest of the other 3 engines.
Do not exceed a maximum of 632°C EGT.

Slowly release brakes so as to minimize the pitch up effect.
Remainder of the takeoff procedures and techniques are the same as for a normal takeoff.

TRAFFIC WATCH

Captain must always be alert to traffic hazards and be sure that either the first officer or himself is watching for traffic at all times where visibility permits. This is particularly important immediately after takeoff and initial climb.

* * *

CLIMB THRUST

Make the initial climb thrust setting using the appropriate target RPM value, when reducing from takeoff thrust.

Retrim to EPR setting, as soon as a stabilized climb condition is established, regardless of desired speed schedule. Maintain climb thrust throughout remainder of climb by adjusting EPR as required.

Either the Climb Thrust Setting chart or the RAT gauge peripheral chart may be used during early stages of climb. As soon as normal climb speed schedule is attained, use the Climb Thrust Setting chart for the rest of the climb.

The climb EPR setting should be checked frequently and reset as necessary. Reset climb EPR just before leveling off for cruise, to establish correct thrust for acceleration from climb to cruise target IAS.

AFTER TAKEOFF CHECK LIST AMPLIFICATION

PILOTS

1. YAW DAMPER . . . . ON
   Place the autopilot switch to YAW DAMPER position to prevent "Dutch Roll" tendencies. The autopilot may be engaged after reaching a minimum of 1100 feet above the ground.
2. GEAR LEVER . . . . NEUTRAL
3. IGNITION . . . . .OFF
   These switches are to be placed to OFF after gear and flaps have been retracted and power has been reduced for climb, unless required for flight conditions.
4. LANDING LIGHTS . . . . RETRACT & OFF
   Do not exceed 290 KTS IAS with outboard landing lights extended. The outboard landing lights will go out as soon as these switches are placed to retract and remain out during retraction. The amber extended light will remain on until the respective lights are retracted.
5. LOGO LIGHTS . . . . OFF
6. SEAT BELT - NO SMOKE . . . . CK

←

HEADING INFORMATION

Variations between heading information while the compasses are operating in the Slave mode may be encountered following turbulence or maneuvering. Therefore, both compasses should be frequently checked against each other and the magnetic standby compass.

When used in the D.G. mode, the compasses are not susceptible to these variations but a periodic check of the heading against the magnetic standby compass must be made.

WEATHER RADAR

Carefully adjusting the radar for use is the key to having a picture that will help you circumnavigate storm cells. For the optimum picture, set radar controls as follows:

a. RANGE - 150 miles

b. GAIN - Full counterclockwise or minimum

c. CONTOUR - Set to NORMAL position

d. INTENSITY - Adjust for desired minimum brilliance. Use sweep line as a guide.

e. Increase gain until snow appears on scope and back off until it disappears. This will be approximately the 12 o'clock position for the control index.

f. Leave gain control set. Adjust brilliance requirements with intensity control as required when changing range settings.

g. TILT - At the higher altitudes, 1/2 to 1 degree down tilt is desirable. This will vary with the aircraft altitude and severity of the rain cell. Slowly adjust the tilt control (from level to 1° down) to determine the tilt angle which most clearly defines the storm center.

TURBULENCE PENETRATION

When turbulence is anticipated, use the weather radar to locate storm cells and to determine the best penetration heading.

Before entering areas of anticipated turbulence:

Secure the seat belt and shoulder harness.

Determine the best penetration altitude, preferably below the 1.5G aerodynamic ceiling. When above 30,000 feet, do not climb to higher altitudes unless the storm can definitely be topped.

Select a heading which will clear the storm cells by five miles when OAT is above freezing, and by ten miles when OAT is below freezing. When at or above 25,000', clear the cells by 20 miles.

Adjust thrust as necessary to maintain the turbulence penetration speed of 280 knots or M.80 - .84 and set stabilizer trim for this speed.

Place all start switches to FLIGHT just before entering areas of known turbulence and precipitation, or when moderate to severe turbulence is encountered unexpectedly.

If turbulence is encountered, the use of autopilot is recommended. If the autopilot is engaged, altitude hold must be off. If the autopilot is not engaged, use the yaw damper.

With autopilot engaged:

Monitor stabilizer trim position periodically since prolonged elevator displacement can cause a significant trim change.

Avoid instinctive pilot action to oppose or soften autopilot corrections in the pitch axis since this may impose high G loads on the aircraft.

URBULENCE PENETRATION (Cont'd)

'ith autopilot off:

Leave stabilizer in a level flight setting and use moderate elevator forces to resist pitch changes.

Use ailerons as required to maintain wings level.

Cautiously adjust thrust as required to attain target airspeed. Keep thrust changes to a minimum and avoid any large changes in thrust.

LIMB PERFORMANCE RECORDS

'he engineer will monitor the engine instruments and maintain record of fuel consumption during climb. Fuel flow readings hould be noted at a point 2/3 of the way to cruising altitude rom altitude where stabilized climb thrust was set. Fuel flow eadings should be taken as required when variable thrust settings re used for step climb conditions.

'he engineer, at the time of recording climb fuel figures, shall heck fixed oxygen supply to detect any trend toward depletion. In longer flights, it is recommended that oxygen pressures be ntered on a portion of the fuel computation log for en route omparison.

/henever specific climb performance data is recorded, use irst officer's instruments wherever possible.

RESSURIZATION AND AIR CONDITIONING SYSTEM

Engineer will monitor pressurization and air conditioning ystems for proper reaction during climb and notify the captain f any malfunctions that have a bearing on the cruising altitude r normal conduct of the remaining portion of the flight.

PRESSURIZATION

After initial differential build-up is noted, vary rate-of-change selector to obtain desired cabin climb rate.

After cabin rate of change has stabilized, turn on second turbocompressor. When turbocompressor airflow is indicated, or cabin rate-of-climb indicates a downsurge, place equipment cooling switch to VALVE OPEN and recirculating fan switch OFF.

Alternate pressure sources may be used in-flight any time the evap air in temperature does not exceed 140°F while they are in use.

TEMPERATURE CONTROL

Because of overlap in the temperature control system, the Freon compressor will come on while the cool air mod valve is still several degrees from full open and still controlling temperature. After reaching cruise altitude, if the Freon run light remains on but electrical load is slight, consider turning off the Freon pack.

Place Freon pack switch OFF and observe inlet duct temperature. If temperature increases, return switch to ON as Freon operation is required.

ALTITUDE INFORMATION

ALTIMETER

The first officer will advise the captain:

When climbing through 1,000 feet below the last assigned altitude.

When reaching the altimeter transition altitude.

Set both pilot's altimeters to 29.92 in. Hg. when passing through the altimeter transition altitude (17,500).

CREW OXYGEN USE REQUIREMENTS

When operating above flight level 410, one pilot at the controls must wear and use an oxygen mask at all times.

When operating above flight level 250, if it is necessary for one pilot to leave his station at the controls of the aircraft for any reason, the remaining pilot at the controls shall don and use his oxygen mask until the absent pilot has returned.

When the requirement for use of oxygen no longer exists, the pilot who was using his mask must check the controls on his regulator to assure that the remaining oxygen supply is not accidentally depleted.

YAW DAMPER

As soon as gear indicates up, place autopilot engage switch to Yaw Damper if other autopilot functions are not to be used at this time.

NOTE

When rudder trim is required for engine-out or other conditions, the yaw damper should be disengaged, rudder retrimmed and autopilot or yaw damper re-engaged. An out of trim condition of the rudder, while on yaw damper, can be detected by noting the three axis indicator for a constant bar displacement or oscillation to one side. Also, a noticeable control displacement (rudder pedals) indicates a need for rudder retrim.

To disengage the yaw damper, the disengage button on either of the pilots' aileron control wheels may be depressed. In this case the Autopilot/Yaw Damper disengage light will not come on.

The yaw damper will disengage or can be disengaged by the following additional items, either one of which will cause the Autopilot/Yaw Damper disengage light to flash.

a. Place Autopilot/Yaw Damper switch to the OFF position.

b. Loss of electrical power from C panel circuit breaker or fuses in the Autopilot Power junction box.

AUTOPILOT ENGAGEMENT

Minimum altitude for engaging autopilot is 1100 feet above the terrain. Aircraft should be in proper trim prior to engaging autopilot. Use pitch trim wheel for pitch control during climb. If MAN mode is used, the turn controller controls aircraft turns. If HDG mode is used, the captain's FPI HDG knob controls heading signals to autopilot. HDG cursor should be centered under lubber line, prior to selecting HDG mode.

* * *

A. CRUISE THRUST

1. When reaching cruising altitude, ~~the captain will~~ gradually level the aircraft and accelerate to ~~appropriate Cruise Chart target~~ IAS. When Chart IAS is attained, ~~the captain~~ will smoothly retard the throttles to ~~specified thrust setting or command the first officer or engineer to do so~~.

2. Normal - Aircraft Meets Chart IAS
When setting cruise thrust, select the proper block (altitude-gross weight, interpolate as necessary) from the single page cruise chart. Wait until the aircraft is on chart IAS. Then set EPR called for in the same block. After the aircraft has become stabilized on speed, record ~~actual~~ instrument indications in the aircraft log.

ok 3. ~~When Aircraft Is Not On Chart IAS~~
~~First recheck to determine that the correct block is being used. Interpolate as necessary. If the thrust setting results in higher than chart IAS, reduce thrust to maintain chart IAS. Should the thrust setting result in something lower than chart IAS, apply additional EPR within engine limits and according to the instructions on the normal cruise or max cruise charts to attempt reaching chart IAS.~~ CAN'T FIND

Set thrust correctly and recheck the chart. Always record actual instrument indications after all corrections or adjustments have been made and ONLY after the aircraft is at a stabilized speed.

Should it be necessary to go as high as max cruise thrust and chart IAS cannot be achieved, accept the lower speed and record actual instrument indications.

4. Max continuous thrust is normally used only for unusual conditions such as regaining speed after a significant loss associated with turbulence penetration.

5. In NO CASE should max continuous thrust be used or EGT limitations be exceeded in an effort to maintain chart IAS.

B. CRUISE PERFORMANCE RECORDS

1. When the flight includes a period of stabilized cruise, the ~~flight~~ engineer shall make appropriate logbook entries. At the time of making the logbook entry the oxygen system pressures shall be compared with those observed during climb. Use first officer's instruments, whenever possible, to determine performance or to make logbook entries.

2. Because of the relationship of OAT and Mach No. to thrust and the necessity of maintaining the proper Mach-Thrust schedule for efficient cruise control, it is essential that precision is exercised in establishing cruise thrust. It will be necessary to interpolate between temperature columns for acceptable accuracy in determining cruise thrust settings and expected performance.

3. The performance of the aircraft is highly sensitive to the effects of altitude, temperature, and speed. In order to efficiently utilize performance charts and to evaluate aircraft conformance to performance standards, it is essential to establish the degree of inaccuracy of altitude, speed, and temperature indications.

4. No significant discrepancies in altimeter indications are known and this can be corroborated by crosschecking the two instruments. Installation error in the indicated airspeed system is nil; however, system tolerances may result in as much as a 6 to 7 KT spread between the two instruments.

5. Because of a .9 temperature bulb recovery factor and a +3° system error the OAT-RAT Conversion Table in Chapter 15 of this Handbook should be used to crosscheck SAT from the KIFIS computer. KIFIS TAS should be checked on the Jeppesen Computer by using CAS and Pressure Altitude to determine True Mach. Place OAT opposite the Mach Index (window under word Denver) with True Mach on the inner scale read TAS on outer scale.

C. AUTOPILOT PROCEDURES

1. Engaging the Autopilot
Minimum altitude for the engagement of the autopilot is 1,100 feet above the terrain. This limitation does not apply to a coupled approach ~~as outlined in this section~~. Before engaging the autopilot, the aircraft should be in trim and autopilot trim indices centered or smoothly floating through center.

NOTE
When aileron or rudder trim is required for engine-out or other conditions, the autopilot should be disengaged, aircraft retrimmed and autopilot re-engaged. An out of trim condition of the aircraft, while on autopilot, can be detected by noting the three axis indicator for a constant bar displacement or oscillation to one side. Also, a noticeable control displacement (aileron wheel or rudder pedals) indicates a need for autopilot disengagement and aircraft retrim. GONE

If one or more of the three trim indices oscillate before the autopilot is engaged but do not oscillate after engagement, autopilot operation may be considered normal.

2. Stabilizer Trim Operation - All Autopilot Modes
When on autopilot, movement of stabilizer manual wheels may appear to be excessive, indicating a possible runway stabilizer. Any time the pitch bar is more than one bar width displaced from center the autopilot will continue to trim until the bar is approximately centered. GONE

CAUTION
If a runaway stabilizer is suspected, disconnect the autopilot. DO NOT APPLY CONTROL COLUMN PRESSURE TO COUNTERACT THE STABILIZER MOVEMENT while on autopilot as this may cause more than one bar width displacement of the pitch bar and continued operation of the stabilizer trim system.

The normal electric stabilizer trim motor is inoperative with the autopilot ON. The autopilot will accomplish automatic pitch trim by means of a small electric motor in the pedestal moving the normal stabilizer trim wheels and cable system.

3. To Fly a VOR Course

a. Set course knob on captain's FPI to desired course and tune VOR frequency on #1 VOR receiver.

CAUTION
Whenever captain is using the #2 VOR receiver (switch in DEV #2 position), the captain and first officer must set both FPI course indicators to the same course selection. If not on the same selection, erroneous information will be fed into the autopilot and Flight Director systems. In the DEV #2 position, the first officer's TO-FROM flags will be inoperative. OUT

C. AUTOPILOT PROCEDURES

With the VOR DEV selected to #2, the autopilot, Flight Director and captain's VOR needle will receive information as follows:

(1) The selected course is controlled by captain's FPI course knob.
(2) VOR displacement is controlled by first officer's FPI course knob.

b. Place autopilot switch to AUTOPILOT. Turn aircraft to the desired intercept heading. Use the autocapture button or place Mode Selector to LOC/VOR for localizer capture.

The autopilot, when ON, will operate the stabilizer to maintain trim.

c. If holding an altitude is desired, place Altitude Hold switch ON. This cuts out the autopilot pitch trim wheel.

NOTE

The All-angle Capture button may be utilized for capturing a VOR radial, as well as an ILS localizer. Select the V/LOC mode for en route navigation after capture is completed.

4. To Fly Pre-Set Heading

a. Fly aircraft (MAN mode or by hand) to desired heading.

b. Set heading knob of the FPI to the desired heading.

c. Place Autopilot switch to AUTOPILOT.

d. Place Mode Selector to HEADING.

e. Use pitch trim knobs for pitch control of autopilot.

f. To maintain a given altitude, place Altitude Hold switch ON. This deactivates the pitch trim wheels.

CAUTION

Since the autopilot air data sensor is shared by the No. 1 Flight Director the following procedure should be observed:

When using autopilot manual pitch trim, turn off altitude hold on the No. 1 Flight Director.

D. FLIGHT DIRECTOR PROCEDURES

The following procedures outline how the captain's (#1) system is to be used.

These procedures also apply to the first officer's (#2) system when the Flight Director Command selector is in the #1 position provided the first officer's Flight Director and #2 VOR are used.

With the Flight Director Command selector in the #2 position, the first officer's Flight Director and #2 VOR must be used and captain's Command Bar is slaved to the #2 Flight Director system.

1. To Fly a VOR Course

a. Set course knob on captain's FPI to desired course and tune VOR frequency on #1 VOR receiver and identify.

b. Place mode selector to LOC/VOR. Adjust pitch command trim to satisfy command bar when desired climb or cruise attitude is established.

SAME

c. To maintain a given altitude, place Altitude Hold switch ON and the command bar will provide altitude pitch information.

CAUTION

When the captain is using the #2 VOR receiver (DEV switch in the #2 position) the captain and first officer must set both FPI course knobs to the same course selection. If they are not set alike, an erroneous problem will be fed into the #1 FLT. DIR. and autopilot. When the DEV switch is in the #2 position, the first officer's ambiguity pointers will be inoperative.

GONE

When the VOR DEV switch is selected to the #2 position, the autopilot, Flight Director #1, and the captain's FPI needle will receive information as follows:

a. The selected course is controlled by the captain's FPI course knob.

b. VOR displacement is controlled by the first officer's FPI course knob.

2. To Fly PRE-SET Heading

a. Set heading knob on captain's FPI to desired heading. Place mode selector to HDG.

b. Adjust command bar, as previously described.

c. If holding an altitude is desired, place Altitude Hold switch ON. This cuts out the Flight Director pitch command knob.

GONE

CAUTION

Since the autopilot air data sensor is shared by the No. 1 Flight Director, the following procedures should be observed:

When using autopilot manual pitch trim, turn off altitude hold on the No. 1 Flight Director.

E. AVM PROCEDURES

SAME

1. Compare stabilized cruise AVM indication with the reading recorded in the log during the previous flight. If no previous log recording is available, the reading being recorded will be considered the initial normal.

2. If an increase of 1.0 mils or less is observed, it should be reported as an engineering note ONLY WHEN A PROBLEM IS SUSPECTED.

3. If the increase is more than 1.0 mils, it should be reported as a malfunction.

ANTI-ICING AND DE-ICING

Monitor the areas around the windshield and engine inlet lip for indications of ice that will dictate use of anti-ice or de-icing procedures. Engine anti-ice should be on if RAT between +5° C and -15° C with any visible moisture present.

PRESSURIZATION SYSTEM

With minimum rate set, select field elevation and then adjust rate of cabin descent as necessary, 300 feet per minute is desirable. Monitor cabin versus aircraft descent rates and advise the captain if the cabin differential will reach zero prior to landing.

If maintaining pressurization is a problem, place equipment cooling switch to FAN ON to close the venturi valve.

DESCENT PROCEDURES

When starting descent, reduce thrust as necessary to maintain aircraft speed below M_{mo} or V_{mo}. To provide adequate bleed air for cabin pressurization requirements hold 75% RPM minimum on inboard engines. Close outboard throttles to idle if minimum thrust is desired.

For descent with wing or engine anti-ice systems on, a higher thrust level will be required. Depending on flight conditions, either carry enough additional thrust on all four engines to keep ice off the engine inlet or advance two symmetrical engines at a time from idle to approx. 80% RPM for 30 seconds and repeat with the other engines. The degree of ice accumulation will dictate how often this latter technique will have to be repeated.

NOTE

> With engine and wing anti-ice both on, the minimum RPM is 75% on all four engines between 22, 500 ft. and 6000 ft. For anti-icing descent with any engine inoperative, see Engine Bleed Air Limits, Chapter 01, this Handbook for limitations.

Do not use spoiler speed brakes in flight except for emergency procedures when called for.

CAUTION

> Do not exceed M_{mo} or V_{mo} and, if used, observe gear and flap maximum speeds.

While in holding patterns, be cautious not to exceed holding pattern maximum airspeeds.

When use of rain clear is anticipated, turn it on early to discharge possible accumulated water from ducting; then turn off if desired. If desired to conserve bleed air for rain clear, depressurize and turn the last turbocompressor off as early as practical, and keep anti-icing off unless required.

ALTITUDE INFORMATION

ALTIMETER

The first officer will advise the captain:

When descending through 1000 feet above the last assigned altitude.

When reaching the altimeter transition level.

When leaving 11, 000 feet for descent to or below 10, 000 feet.

Set both pilot's altimeters to local altimeter setting when descending through FL 180 or the lowest usable flight level.

When resetting the altimeter, always approach the desired setting from a lower pressure value. Do not overshoot or bracket. Crosscheck altimeter indications frequently.

ALTITUDE ALERT

When descent is commenced, set the altitude alert system for each altitude assigned prior to final approach fix. Do not use beyond this point to avoid confusion of tones from the aural terrain warning system.

* * *

1557

Vref min

135

140

145

145

RADAR APPROACH DESCENT PROCEDURE

When cleared to descent prior to final approach, descend to 1000 feet above target altitude using minimum thrust for existing conditions.

When a significant altitude change is required at a high rate of descent use 190 KTS, flaps 30° and gear as desired. When reaching 1000 feet above the assigned altitude, adjust rate of descent so as not to go below the assigned altitude.

FINAL APPROACH SPEED

Final approach speed for normal approaches is bug + 5 knots plus 50% of any gust value.

On the abnormal approaches listed in chapter 03, where the procedure is to fly the approach at bug speed, use a final approach speed additive of 50% of any gust value plus an additional 5 knots if the steady wind is 20 knots or greater.

LANDING PRELIMINARY CHECK LIST AMPLIFICATION

PILOTS

1. SEAT BELT SIGN . . . . ON

Since it may take 15-20 minutes for the flight attendants to distribute the personal effects of the passengers, placing the seat belt sign on, in some cases, may precede the reading of this portion of the check list.

2. LOGO LIGHTS . . . . CK

Turn lights on only during the hours of darkness before midnight.

3. ANTI-ICE SYSTEMS . . . . CK

Check status of all anti-ice systems and turn off those which are not needed for descent and landing.

4. EMERGENCY BRAKE PRESSURE . . . . CK

Note the amount of air pressure available for emergency brake operation.

5. G.W. & AIRSPEED BUGS . . . . SET & CROSSCK

The engineer shall have available the estimated landing gross weight. The IAS bugs should normally be set to the boundary speed as determined from the cockpit placard.

If landing weight is less than the lowest shown on the boundary speed placard on the aircraft, use the lowest speed shown as reference.

6. ALTIMETERS . . . . SET & CROSSCHECK

Set both barometric altimeters to current altimeter setting, approaching desired setting from a lower pressure value. Set bugs for barometric and radio altimeters:

On instrument approaches the radio altimeter bug will be set to the HAT or HAA published for the approach to be flown. The barometric altimeter bug will be set to the DH or MDA published for the approach to be flown.

On non-instrumented approaches the radio altimeter bug will be set to 500' and the barometric altimeter bug will be set to 500' above the airport elevation.

7. GO AROUND EPR . . . . SET

Set the EPR bug to the correct EPR for missed approach immediately after setting the IAS bugs. EPR setting will be determined by the engineer using the Takeoff Thrust setting chart for the existing airport conditions.

ENGINEER

1. CABIN ALTITUDE . . . . CK

2. REPLENISH PUMPS . . . . CK

Since the replenish pumps may be needed to empty or reduce the fuel quantity in 2R or 3R, the answer should be the actual pump condition.

3. CIRCUIT BREAKERS . . . . CK

Recheck the condition of all the circuit breakers on panels A, B, C and below engineer's desk.

SCAT AND AUTOTHRUST

Slow-fast pointers center when at the appropriate V_{ref} speed for existing flaps. For example:

Flaps up . . . V_{ref} + 50 KTS
Flaps 20 . . . V_{ref} + 30 KTS
Flaps 30 . . . V_{ref} + 20 KTS
Flaps 40 . . . V_{ref} + 10 KTS
Flaps 50 . . . V_{ref} + 5 KTS

Cross check the slow-fast pointers with IAS.

If autothrust is to be used during the approach, it should be engaged when the slow-fast pointers are approximately centered. For best results, the aircraft should be in the approach configuration, with flaps extended. Autopilot and flight directors can be used in combination with autothrust, if desired. Throttles should be closely monitored during the approach, so that pilots can override or disengage autothrust if conditions warrant.

Disengage autothrust not later than DH, by depressing either autopilot disconnect button.

BASIC ILS APPROACH PROCEDURES

Preliminary check list should be completed 10-15 minutes before beginning approach. Yaw damper switch ON.

Tune localizer frequency on both VORs and identify. If localizer has co-located DME, place DME normal-override switch in NORMAL position (this reduces DME range to 50 miles) and identify.

Set inbound front course on both FPIs with FPI course knobs. This will allow fly to the needle sensing for either a front or back course approach.

Extend flaps to 20° and maintain Bug +30 KTS minimum speed. Read Final check list.

When cleared by ATC for an ILS approach:

Remain on last assigned vectored heading if final approach course intercept is less than 45°, or

Turn to intercept the localizer course at a proper intercept angle (less than 90°) if not ATC vectored, or

If procedure turn is necessary, start turn 30 seconds past LOM (depending on wind).

Extend flaps to 30° and maintain bug + 20 KTS minimum speed prior to intercepting localizer course inbound.

NOTE
See Crew Coordination procedures outlined in Section 02.01, this chapter.

When the localizer needle starts moving from full deflection, maneuver to intercept the localizer course.

When the glide slope becomes alive, extend landing gear and complete final check list. Start speed bleed. When glide slope is one dot above center, extend flaps to 40°, and continue speed bleed.

Upon reaching the LOM and at glide slope intercept, extend flaps to 50°, bug + 5 KTS minimum speed and establish rate of descent to remain on glide slope.

When approaching the threshold, disengage yaw damper.

ENGINE OUT ILS

The basic procedures previously outlined are to be used along with the following:

During the procedure turn or not later than passing the outer marker inbound, rudder trim should normally be used to relieve the pedal force. Use the rudder to prevent any severe yaw from developing when increasing or decreasing thrust. Keep the ball in the bank indicator as close as possible to center throughout the approach.

Flap sequencing for a 2 engine approach differs from that of a 4 or 3 engine approach. See 2 Engine Landing procedure on Other Emergencies Guide or refer to Section 03.12.

AUTOPILOT ILS APPROACH (AUTOCAPTURE BUTTON)

Reference autopilot ILS approach diagram and Crew Coordination procedures 02.51 section.

Do not use autopilot for back course ILS approaches. If approach is continued below 1100 feet above the terrain, autopilot must be coupled to both localizer and glide slope.

Engage autopilot. Select either heading or manual mode for initial maneuvering. Heading mode is recommended. Manual mode can be used as an alternative or if the first officer is making the approach. When heading mode is used, the captain's FPI heading knob controls heading information to the autopilot.

Tune both VORs to ILS frequency and set ILS inbound front course on both FPIs.

Depress the autocapture button. Check for capture button light illuminating and that the V/LOC and GS annunciators indicate arm.

Use the pitch wheel for controlling descent. Engage altitude hold when assigned altitude is reached. If the captain's flight director and the autopilot are used at the same time, altitude hold on the autopilot must be turned on first.

When approaching final intercept, or when outer marker outbound extend flaps to 30 degrees and slow to a minimum of bug + 20 knots. If using the MAN mode, the turn control must be in the center detent, prior to localizer becoming alive, or capture will not take place.

If aircraft is vectored through the localizer, pull out the autocapture button. After the localizer is crossed and the localizer needle is fully deflected, again depress the autocapture button to re-capture course.

After localizer becomes alive, the aircraft will begin capture. The V/LOC annunciator will indicate on. If in heading mode, the mode selector will trip to the manual mode, and autocapture button will remain in.

After the localizer is approximately centered, wind integration will begin. The maximum crab angle is approximately 20 degrees.

When the glide slope indicator is alive, extend the landing gear. When the aircraft is one dot below glide slope, extend flaps to 40 degrees, and reduce speed to bug + 10 knots. Just prior to glide slope centering, glide slope capture takes place. The GS annunciator will trip to on. Extend flaps to 50 degrees and maintain bug + 5 knots. Altitude hold will trip off.

F. **AUTOPILOT ILS APPROACH (AUTOCAPTURE BUTTON)**

10. Desensitization of localizer and glide slope signals, and aircraft bank angle reduction, begin at glide slope intercept. The maximum signal reduction is completed 1500 feet after glide slope interception. At this time, localizer signals are reduced 50% and glide slope signals are reduced 75%. The maximum bank angle reduction is complete in one minute from 30 degrees to approximately 17 degrees. If strong crosswinds exist, and signal strength and bank angle is not sufficient to keep aircraft on glide slope or localizer, then resensitization can be accomplished. This is initially accomplished by placing mode selector to GS MAN. Later on, during the approach, if resensitization is again desired, place the mode selector to V/ LOC, then GS MAN each time this action is required. Autopilot resensitization should not be accomplished after reaching the LOM or 1500 feet above the terrain, whichever occurs first.

11. Approaching minimums check the elevator out of trim light and the elevator index of the autopilot three axis trim indicator, for a possible out of trim condition. Be prepared to compensate for any out of trim condition that exists when disengaging the autopilot.

12. Disengage the autopilot when executing a missed approach, or not later than DH.

G. **FLIGHT DIRECTOR ILS APPROACH**

Reference Flight Director ILS Approach diagram and crew coordination procedures 02. 51 section, this chapter.

Do not use the flight director when making a back course ILS approach.

During the ILS approach, the pilot should guard against over concentration on the command bar. The approach should be monitored by reference to the basic ILS display on the FPI.

1. Engage both flight directors in HDG mode for initial vectoring.

2. Tune both VORs to the ILS frequency and set the inbound front course on both FPIs.

3. Set the FPI HDG cursors to the assigned ATC headings for proper flight director commands.

4. Engage ALT HOLD when the assigned altitude is reached. Turn ALT HOLD off when changing altitudes.

5. When approaching final intercept, or OM outbound, extend flaps to 30 degrees and slow to a minimum of bug + 20 knots.

6. When localizer becomes alive, place mode selectors to LOC/ VOR mode to follow capture command.

7. After localizer is approximately centered, wind integration will begin. The maximum crab angle is approximately 15 degrees. Wind integration will temporarily be lost, if mode selector trips to SCAT mode from either LOC/ VOR or GS mode. It will take approximately 30 to 40 seconds to restore normal wind integration, once mode selector is again placed back in LOC/ VOR or GS mode.

8. When the glide slope indicator is alive, extend the landing gear. When the aircraft is one dot below the glide slope, extend the flaps to 40 degrees and reduce speed to bug + 10 knots.

9. When the glide slope indicator centers, place mode selector to GS mode. ALT HOLD will trip OFF. Extend flaps to 50 degrees and maintain bug + 5 knots.

10. Disengage flight director when initiating missed approach or when landing is assured.

H. **FLIGHT DIRECTOR DISENGAGEMENT**

Disengage flight director when initiating missed approach or when landing is assured.

1. Separate disengagement is provided each pilot by placing his respective mode selector to OFF, or depressing his autopilot disconnect button.

2. When the autopilot disconnect button is used, that mode selector will trip to the SCAT mode. The command bar will indicate SCAT commands, instead of flight director commands.

3. When the mode selector is placed in the OFF position, the command bar will retract from view.

4. Either mode selector will trip to SCAT mode if power to the respective flight director computer fails.

5. In the GS mode, a selector will return to SCAT if:

   a. DC power to the respective VOR fails.

   b. Respective VOR is rechanneled.

6. The captain's flight director mode selector will trip to SCAT if:

   a. FLT DIR COMMAND switch is placed in the #2 position.

   b. DEVIATION VOR switch is placed in the #2 position when captain's mode selector is in radio mode.

I. **NORMAL ALL ENGINE APPROACH AND LANDING**

1. Establish the downwind leg 1500' above field elevation with flaps at 30° and speed, bug +20 KTS.

2. Turning base, extend the gear and position the flaps to 40°.

3. On base leg, with speed at bug +10 KTS, complete the Landing Final check list and establish a normal rate of descent.

4. Turning to final approach, extend flaps to 50° and slow to bug +5 KTS. Adjust sink rate so as to be stabilized in the normal approach slot as soon as practicable but no later than 500 feet above field elevation.

5. Use stabilizer trim throughout approach to keep elevator forces near zero. Maintain speed at bug +5 KTS. Frequently cross check sink rate, pitch attitude and visual position of the 1000 feet touchdown target to maintain aircraft in the approach slot.

NOTE

The above sequence describes an approach from a downwind leg. A visual approach can be conducted from any final intercept angle. Program the speed and configuration changes so as to be stabilized in the approach slot 500 to 800 feet above the field elevation.

NORMAL ALL ENGINE APPROACH AND LANDING

Technical information relative to a visual approach may be found in chapter 6 of the Flight Operations Policy Manual.

WARNING
THRUST IS NOT LINEAR TO THROTTLE MOVEMENT. KEEP ENGINES "SPUN UP". DO NOT ALLOW EXCESSIVE SINK RATE OR SPEED CHANGE TO DEVELOP NEAR THE GROUND. SPIN UP TIME FROM IDLE TO TAKEOFF THRUST MAY TAKE AS LONG AS 6 SECONDS.

. Commence flare and slowly reduce power so that throttles are closed at touchdown.

CAUTION
If the flare is completed and touchdown does not occur, the back pressure on the control column should be eased off and the aircraft put on the ground by easing the nose down. Do not try to hold the aircraft off as floating will result, causing an excessive amount of runway to be used. Also, a hard landing will usually be made if back pressure is being applied at touchdown as this tends to drive the gear trucks into the grou 1d.

Technical information relative to touchdown target may be found in chapter 6 of the Flight Operations Policy Manual.

'. If the aircraft bounces or balloons, avoid extreme attitude changes and use the following steps to recover:

a. Hold or re-establish a normal landing attitude.

b. Add thrust as necessary to control the touchdown airspeed. (No thrust increase will be necessary if a shallow bounce or skip occurs).

c. If bounce is high and excessive runway will be used to recover, execute a missed approach. A second touch-on may occur during the go around. Do not retract the landing gear until a positive rate of climb is established.

CAUTION
Do not push over as this may cause another bounce and possibly damage the nose gear.

Do not increase the pitch attitude above normal as this only increases the height of the bounce and could even cause the tail to strike the runway. This results in a second hard touchdown.

Be alert for yawing when advancing the throttles to takeoff position due to asymmetric thrust.

8. Extend the spoilers immediately after the main gear touches down. At the same time, start lowering the nose wheel smoothly using a combination of elevator control and light braking action. Raise the reverse levers to the interlock position as soon as possible after spoiler extension and apply maximum reverse thrust as the nose wheel touches down. Refrain from hard braking unless necessary.

a. Regardless of who is making the landing, the captain will actuate the Speed Brake Handle.

b. If the first officer is the operating pilot, he will call "Spoilers" and the captain will respond "Spoilers" as he pulls the handle aft. This will prepare both pilots for any aircraft pitch/roll reaction resulting from spoiler extension.

9. Keep the wings level using the ailerons and maintain directional control with rudder. Brakes should be used if required to aid in maintaining directional control.

CAUTION
Do not use nose wheel steering at high speeds (above approximately 80 KTS.)

10. The first officer should call "80 KTS" when the aircraft has decelerated to that speed during the landing roll.

When reaching 80 KTS, smoothly decrease reverse thrust so as to reach Reverse idle at 40 KTS. Use of reverse thrust should be terminated after 30 seconds or at runway turnoff whichever comes first.

11. When turning off the runway or when the landing roll phase is completed and starting to taxi:

a. Check brake pressure

b. Retract flaps and spoilers

J. **CONSIDERATIONS WHEN USING REVERSE THRUST**

Normal thrust reversing is outlined in the Normal 4-Engine Approach and Landing portion of this section. There are, however, some other factors to be aware of when using reverse thrust.

1. When in reverse, if corrective action is taken to maintain directional control and it is not effective, return the throttles to Reverse Idle and stop the aircraft using spoilers and brakes. Stopping distances are based on using spoilers and brakes, without using reverse thrust on a smooth, dry hard-surfaced runway.

If directional control is still a problem, it may be necessary to use forward thrust to re-align the aircraft with the runway.

Loss of directional control on dry runways during landings or aborted takeoffs is characterized by the ability to control the heading of the aircraft but not its track. The problem centers around the cornering capability of the tires.

Technical information relative to this subject is found in Chapter 6 of the Flight Operations Policy Manual.

2. With one thrust reverser system not available, such as an engine out or a reverser system inoperative, first initiate maximum reverse thrust on the symmetrical engines. Then apply reverse thrust, if needed, on the remaining engine as directional control will permit.

3. When reverse thrust is needed and only asymmetrical reverse thrust is available, apply as much reverse thrust on the inboard engine as directional control will permit. Utilize the outboard engine reverse thrust to the extent possible.

4. Reverse thrust produces a "nose up" pitching moment. Proper application of braking and nose down elevator, as reverse thrust becomes effective, will keep the nose wheel on the ground.

5. DO NOT RETURN THROTTLES RAPIDLY FROM HIGH REVERSE THRUST TO FORWARD THRUST. This w accelerate the aircraft because of the high residual when the engine returns to forward thrust.

K. **CROSSWIND LANDING TECHNIQUE**

1. Establish a track on the extended runway centerline by crabbing into the wind.
2. Maintain the crab angle until the landing flare is completed.
3. As the flare is completed, apply rudder to align the aircraft with the runway, keeping the wings level by applying opposite aileron.
4. As runway alignment is attained, ease off the back pressure on the elevators and put the aircraft on the ground.
5. Use normal stopping techniques, keeping wings level with the ailerons.

CAUTION

Care should be exercised in the use of lateral control during the landing ground roll. Excessive aileron application causes a significant differential spoiler extension which induces spoiler yaw. Therefore, apply only the amount of aileron necessary in a steady and positive manner.

L. **ONE ENGINE INOPERATIVE LANDING**

A 3-engine approach and landing is the same as a 4-engine with the following exceptions:

1. During asymmetrical power condition, be alert on rudder to maintain directional control. Keep the ball centered and minimize use of ailerons for directional control.
2. At the lighter gross weights, check that final approach speed. (Bug + 5 KTS) is V_{mca} or above.

M. **TWO ENGINE INOPERATIVE APPROACH AND LANDING**

See cockpit OTHER EMERGENCIES GUIDE and 03.12 in this Handbook for the procedure amplification.

N. **MISSED APPROACH PROCEDURES**

See Chapter 03.12, this Handbook, for all engine, one and two engine missed approach procedures. Two engine go-around (missed approach) procedures are also in the cockpit OTHER EMERGENCIES GUIDE.

O. **LANDING FINAL CHECK LIST AMPLIFICATION**

PILOTS

1. ALTIMETERS . . . . SET & CROSSCHECK
Crosscheck both altimeters for the same setting and check for any differences in indication.
2. NO SMOKING. ON
3. YAW DAMPER . . . . CHECK
Yaw damper may remain engaged during final approach but must be disengaged prior to the flare for landing.

   If large rudder deflections are required to maintain directional control such as during approach or cross-wind landing or when applied thrust is asymmetrical, disengaging Yaw Damper will reduce pedal forces.
4. BRAKE & HYDRAULIC SYSTEM PRESSURES . . . .CK
Check that both hydraulic systems are pressurized and that brake pressure equals or exceeds No. 2 system pressure.

WHEN GEAR EXTENDED

5. GEAR & ANTI-SKID . . . . DOWN & CHECK
Check for three green lights on and all red gear and door lights out. If the main gear is extended manually, the door light will remain on.

   Check that Anti-Skid switch is ON and Nose Wheel Brake Switch is NORMAL. Both Anti-Skid Inoperative lights should be out and all release lights should be on. Refer to Anti-Skid System Fault, Chapter 06.01, if the system is not indicating properly.
6. FLAPS . . . . ______ DEGREES
   a. Call out the degree of flap extension.
   b. Check to assure the flaps are fully extended prior to landing.
7. HYDRAULIC QUANTITY . . . . .CHECK
Check fluid level in both hydraulic systems.

ENGINEER

1. FUEL PUMPS. . . . . MAINS ON
Check that all boost pumps and main transfer pumps are on.
2. CROSSFEED VALVES . . . . .CLOSED
All crossfeed valves should normally be closed. If less than 1500 pounds of fuel remains in a tank with an inoperative main transfer pump, crossfeed the affected tank with the adjacent tank on the same side. Do not close tank line valve.

P. **CABIN PRESSURIZATION**

NOTE

When use of rain clear is anticipated, it is desirable to conserve bleed air for rain clear so depressurize early and turn the last turbocompressor off as soon as practical.

1. Standby to turn turbocompressors OFF in case of a go around.
2. When cabin differential is reduced and cabin altitude starts descending with the aircraft, turn a turbocompressor OFF. Turn the recirc fan ON when the runway is in sight. As the second turbocompressor is turned OFF, the equipment cooling low airflow light will come on. It is not necessary to place the equipment cooling switch to FAN ON unless the low airflow light remains on after landing.

Q. **WING FLAPS**

Leave wing flaps down during landing deceleration to provide additional drag. Retract, SCD, when taxi operation begins.

R. **AFTER LANDING CHECK LIST AMPLIFICATION**

CAPTAIN

1. BRAKE PRESSURE . . . . .CHECK
This should be monitored by the first officer during brake application after touchdown to detect any sudden loss of brake pressure available.
2. RADAR & TRANSPONDER. . . . . OFF
Turn both radar and transponder switch OFF. Turning off the transponder will reduce ATC scope clutter. Turning off radar is precautionary measure prior to entering ramp area.
3. FLAPS . . . . UP
4. SPOILERS . . . . DOWN
5. STABILIZER . . . . 2°
To minimize moisture entry into the tail cone area, internal portions of the stabilizer and to prevent inadvertent operation against the stops, set stabilizer to 2° nose up.
6. PITOT & WING HEAT. . . . . .OFF

AFTER LANDING CHECK LIST AMPLIFICATION

ENGINEER

. AUX HYDRAULIC PUMP . . . . ON
The AUX HYD PUMP is placed to ON to provide #2 HYD SYS back-up for initiation of 3-ENG taxi-in procedure.

. TURBOCOMPRESSORS . . . . OFF

. ALT PRESS SOURCES . . . . CLOSED

. RECIRC FAN . . . . ON

. PRESSURE REGULATORS . . . . AUTO
This will allow the regulators to be opened electrically, as a function of the landing gear safety switch system, to keep aircraft depressurized on the ground.

THREE ENGINE TAXI PROCEDURE

. When conditions after landing indicate it is practical, taxi to the station on three engines.

. Only #3 engine is to be shut down providing:

a. Clear of runway.

b. All engines in forward thrust.

c. All remaining hydraulic pumps are functioning properly and the auxiliary hydraulic pump is ON and functioning normally.

d. The generators on engines 1, 2 and 4 are operating and the electrical power system has been functioning normally.

* * *

A. **GROUND AIR CONDITIONING**

If an extensive delay is incurred waiting for gate space, use one or both turbocompressors to supply fresh air. If exhaust fumes are noted or the aircraft is positioned to be vulnerable to exhaust fumes, use recirculating fan only.

B. **TAXI ELECTRICAL LOAD REDUCTION**

Keep electrical load to a minimum for ramp operation. Prior to reaching the ramp turn off the fuel boost pumps.

To achieve maximum passenger comfort, retain air conditioning systems during taxi as long as possible but do not exceed 36 KW generator load.

Just prior to shutting the engines down turn off the Freon packs and recirculating fan.

C. **RAMP MANEUVERING**

When parking at jetway ramp positions, in order to terminate at the proper position, it is necessary to use a full turn on nose steering followed by a slight back-off of the steering wheel. During other maneuvering, to avoid excessive nose wheel tire wear, limit maximum turn to 56° when possible.

D. **ELECTRICAL POWER CHANGEOVER**

When parked in position, shut down #2, #3 and #4 engines. Leave #1 at idle to provide electrical power until external power is connected. Check voltage and frequency of the ground power supply before selecting EXTERNAL POWER. If voltage or frequency is out of limits or if no external power is available, leave the switch in the OFF position, then shut down #1 engine.

E. **ENGINE SHUTDOWN**

Be sure the throttles are fully closed and RPM has decreased to idle before placing start levers OFF. To assure proper turbine cooling, the engine should be operated at idle speed for a minimum of one minute before shutdown. For this purpose all operation at RPM of 80% or below may be considered idle speed.

CAUTION
DO NOT OPERATE THE EMERGENCY IGNITION STATIC INVERTER FOR MONITORING EGT EXCEPT AT STATIONS WHERE NO GROUND POWER OR PERSONNEL ARE AVAILABLE.

F. **SECURE COCKPIT, CHECK LIST AMPLIFICATION**

CAPTAIN

1. PARKING BRAKE . . . ON
2. EMERGENCY EXIT LIGHTS . . . SHUT DOWN
   The emergency DC bus must be powered prior to placing the switch to shutdown.
3. ENGINE AND WINDSHIELD HEAT . . . OFF
4. BEACON LIGHTS . . . OFF
   Turn light OFF after the last engine is shut down, day or night.
5. RADIOS . . . OFF
   → Turn essential and normal radio switches off.

FLIGHT ENGINEER

1. AUX. HYD. PUMP . . . OFF
2. FUEL PUMPS . . . OFF
   The fuel boost and transfer pumps are to be turned off prior to electrical power changeover.
3. FLIGHT RECORDER . . . OFF
4. FLT TERM - WATER PUMP . . . OFF
   Turn pump OFF at flight termination only.
5. FLT TERM - OXYGEN SYSTEM . . . OFF
   Close the oxygen supply valves on the passenger and crew fixed oxygen cylinders.

G. **FUEL FLOW INDICATOR SYSTEM**

To increase the service life of the fuel flow transmitters, open the four FUEL FLOW IND. circuit breakers on breaker panel A .

H. **WING ICE LIGHTS**

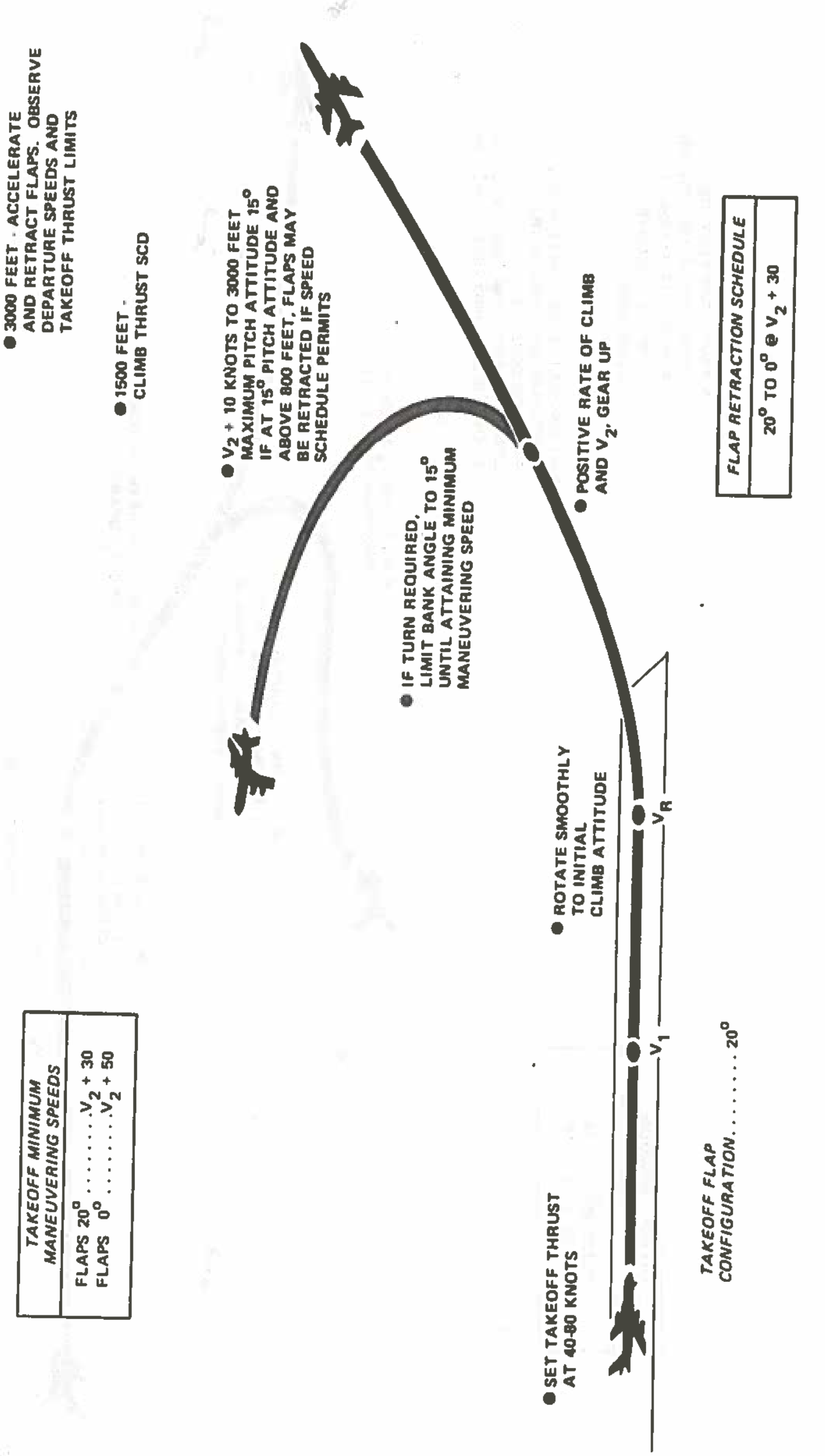
During the hours of darkness, after the engines are shut down, the wing ice lights are turned on for area illumination.

I. **BATTERY SWITCH**

Place the battery switch to NORMAL. This will connect the charger TR to the battery. (Ground personnel will turn the battery switch OFF at flight termination.)

* * *

FOUR ENGINE NORMAL TAKEOFF



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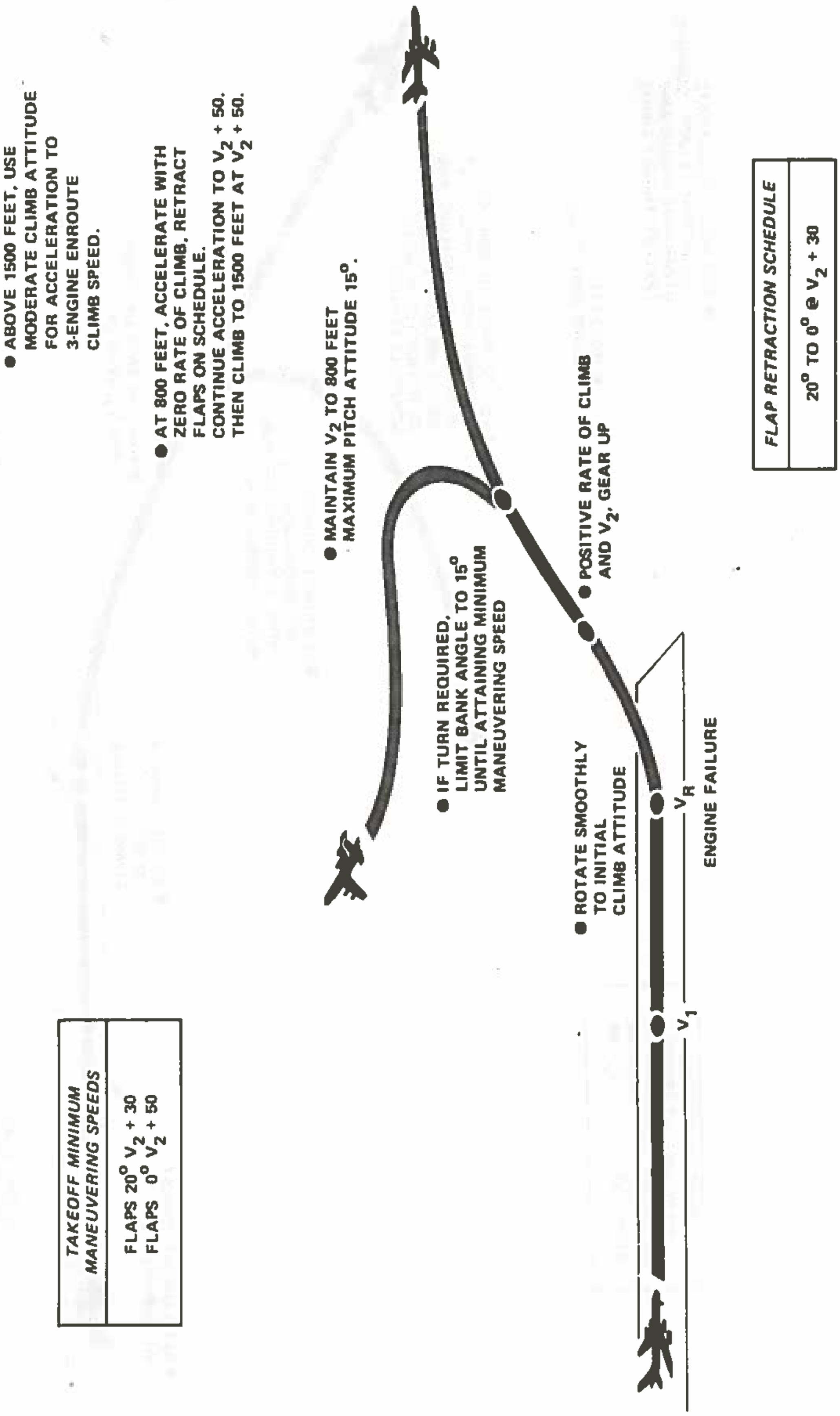
ENGINE FAILURE AFTER V_1



FLAP RETRACTION SCHEDULE
20° TO 0° @ V_2 + 30

TAKEOFF MINIMUM MANEUVERING SPEEDS
FLAPS 20° V_2 + 30 FLAPS 0° V_2 + 50

(5599)

A.

HOLDING PATTERNS AND PROCEDURES

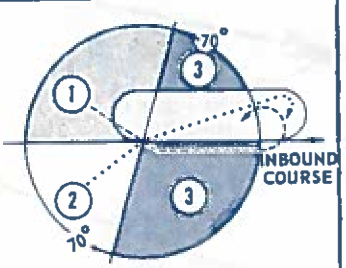
Entry into Holding Patterns

STANDARD PATTERN

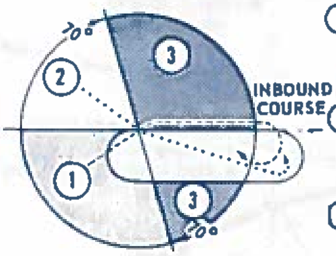
1 Parallel Procedure
Parallel holding course, turn left, and return to holding fix or intercept holding course.

2 Tear Drop Procedure
Proceed on outbound track of 30° (or less) to holding course, turn right to intercept holding course.

3 Direct Entry Procedure
Turn right and fly the pattern.



NON-STANDARD PATTERN



1 Parallel Procedure
Parallel holding course, turn right and return to holding fix or intercept holding course.

2 Tear Drop Procedure
Proceed on outbound track of 30° (or less) to holding course, turn left to intercept holding course.

3 Direct Entry Procedure
Turn left, and fly the pattern.

TWA HOLDING PROCEDURES

A. Above 14,000' hold clean, use chart speed but not above FAA maximum speeds without ATC approval.

B. 14,000' and below:

1. Flaps 20 Bug + 30
2. Should a prolonged hold be anticipated, consider holding clean. (Bug + 50 minimum.)

FAA MAXIMUM AIR SPEEDS

A. Holding in holding pattern - Arrivals.

1. Thru 6,000' MSL - 200 KTS IAS
2. Above 6,000' thru 14,000' MSL - 210 KTS IAS
3. Above 14,000' MSL - 230 KTS IAS

B. Climbing in holding pattern - Departures

310 KTS Maximum
Speed limited by buffer zone around holding pattern.
Limit speed to 250 KTS. below 10,000'.

PILOT ACTION

A. Speed should be reduced to the appropriate FAA maximum holding speed or less, within three minutes of holding fix ETA.

B. Make all turns during entry and while holding at:

(1) 3° per second or.
(2) 30° bank angle or.
(3) 25° bank angle using a flight director system; use whichever requires the least bank angle.

C. Compensate for known effect of wind, except when turning.

D. Advise ATC immediately if increase in airspeed is necessary due to turbulence, or if unable to accomplish any part of the holding procedure.

TIMING

A. Inbound Leg

14,000 MSL or below	Above 14,000 MSL
1 Minute	1 1/2 Minutes

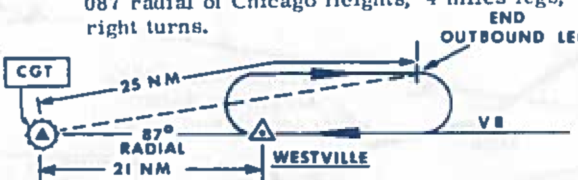
The initial outbound leg should be flown for 1 minute or 1 1/2 minutes (as required by altitude). Timing for subsequent outbound legs should be adjusted as necessary to achieve proper inbound leg time.

B. Outbound timing begins over or abeam the fix whichever is later. If the abeam position cannot be determined start timing when turn to outbound heading is completed.

EXAMPLE OF DME HOLDING

Example 1:

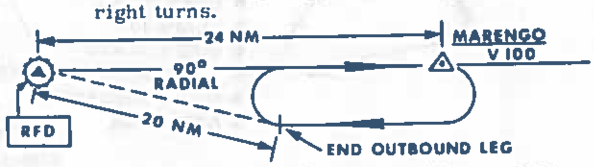
Clearance: Hold East of the Westville 21 mile DME fix on the 087 radial of Chicago Heights, 4 miles legs, right turns.



Where the DME holding pattern is on the side of the fix away from the VORTAC, the end of the outbound leg is the DME fix plus the leg length (21 + 4 = 25). This would also be true if the clearance specified left turns. Mileage shown in the pattern indicates leg length is added to fix mileage.

Example 2:

Clearance: Hold West of the Marengo 24 mile DME fix on the 090 radial of Rockford, 4 mile legs, right turns.

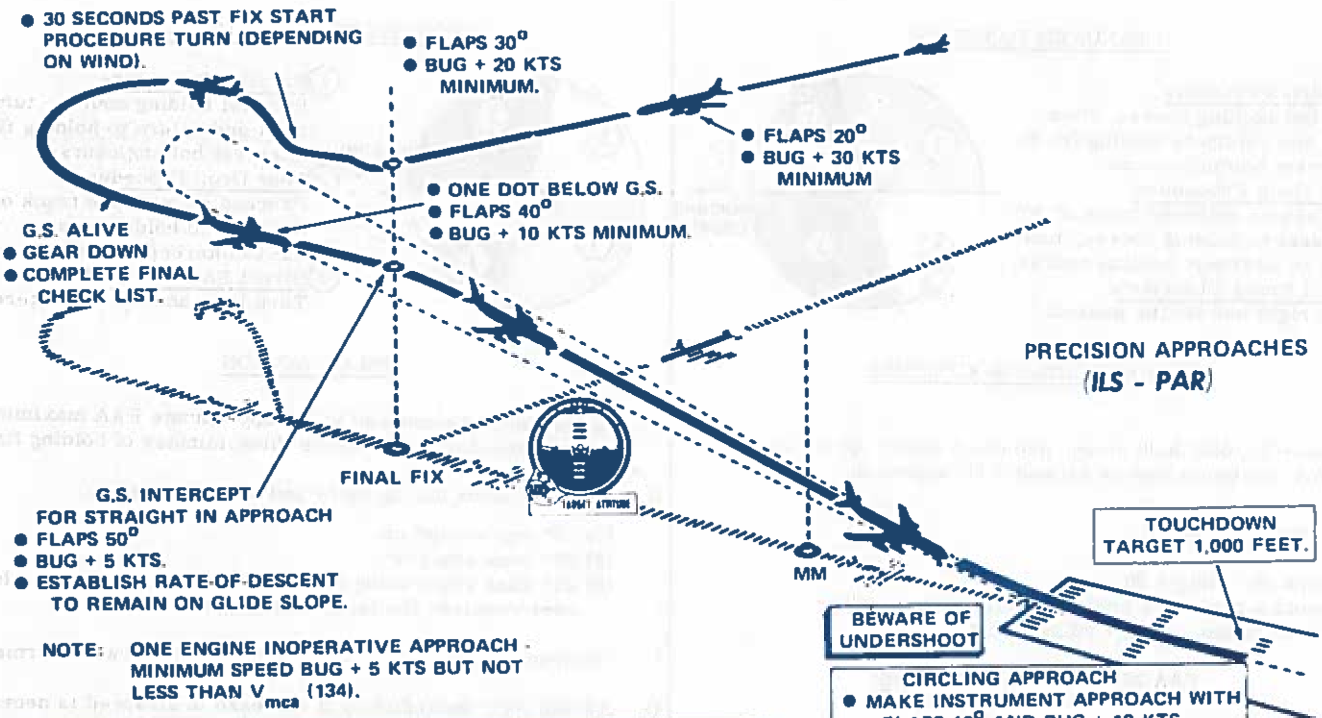


Where the DME holding pattern is on the side of the fix toward the VORTAC, (between the fix and the VORTAC), the end of the outbound leg is the DME fix minus the leg length (24 - 4 = 20). This would also be true if the clearance specified left turns. Mileage shown in the pattern indicates leg length is subtracted from fix mileage.

NOTE

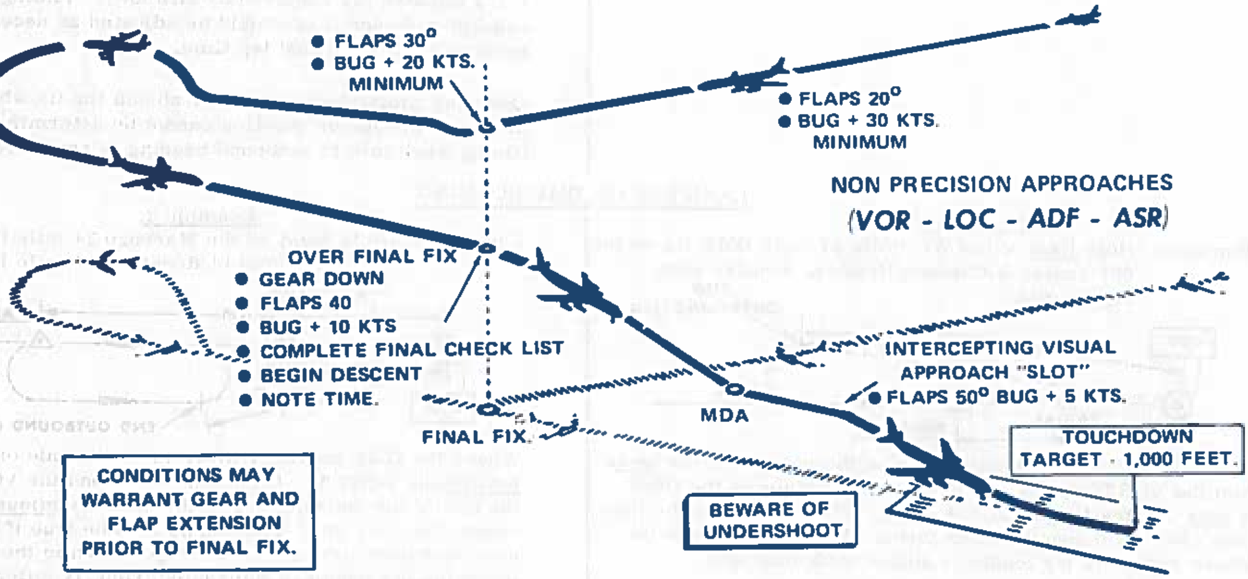
DME holding is subject to the same entry and holding procedures that are normally used, except that distances (Nautical miles) are used instead of time values. You may be instructed to hold on a specified radial or an airway radial.

. INSTRUMENT APPROACH PROCEDURES - ALL ENGINES OR ONE ENGINE INOPERATIVE



2-ENGINE INOPERATIVE APPROACH

1. INBOUND TO FINAL FIX FLAPS 20° - BUG + 30 KTS. (NOT LESS THAN 160 KTS).
2. AT THE FINAL FIX - GEAR DOWN. (CIRCLING APPROACH GEAR UP UNTIL TURNING FINAL.)
3. ON APPROACH PATH; MAINTAIN FLAPS 20° BUG + 30 KTS. (NOT LESS THAN 160 KTS.) UNTIL COMMITTING AIRCRAFT TO LAND.



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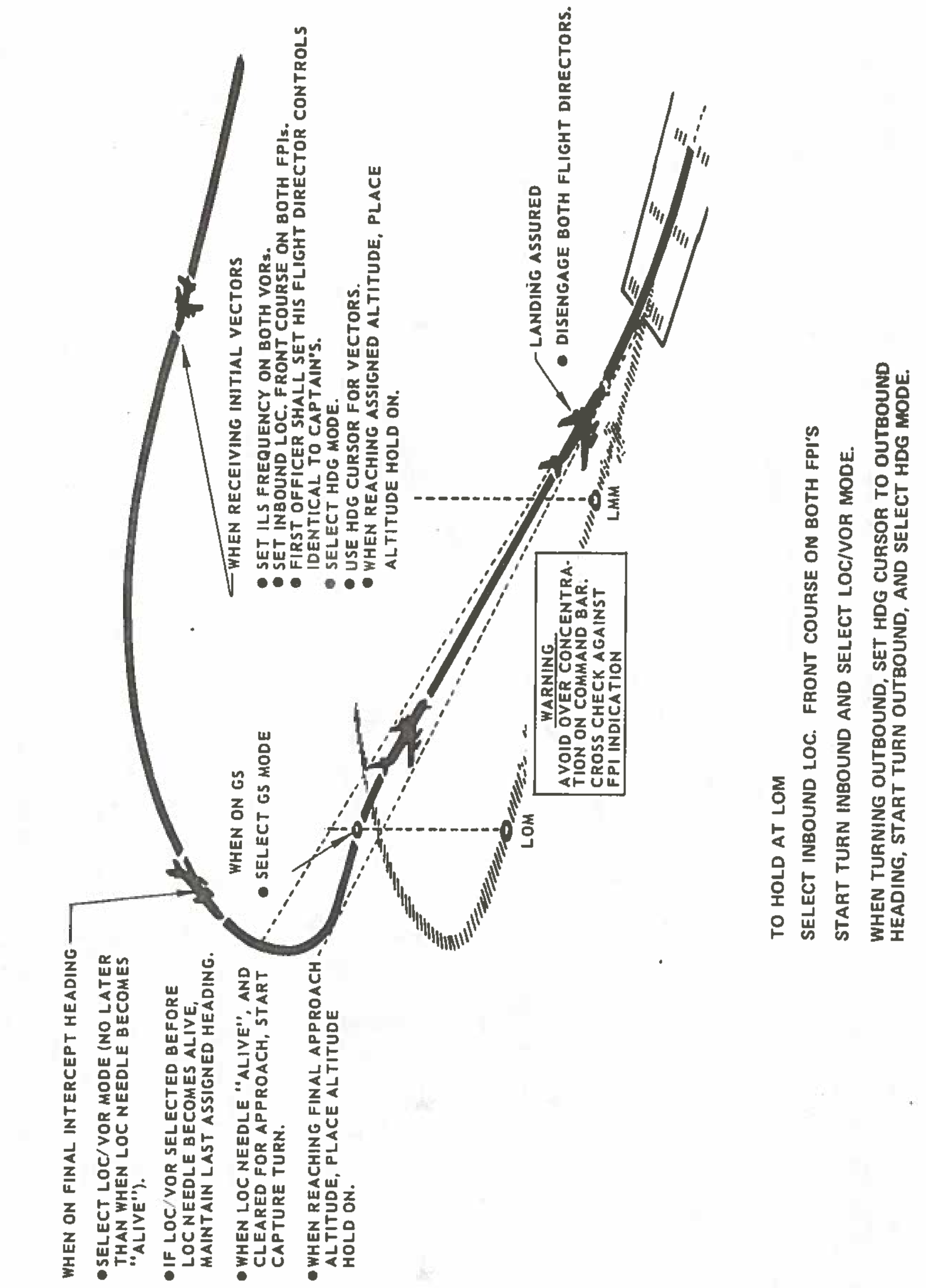
FLIGHT DIRECTOR - ILS APPROACH - VECTORED



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AUTOPILOT ILS APPROACH - AUTOCAPTURE BUTTON

WHEN CLEARED FOR APPROACH:

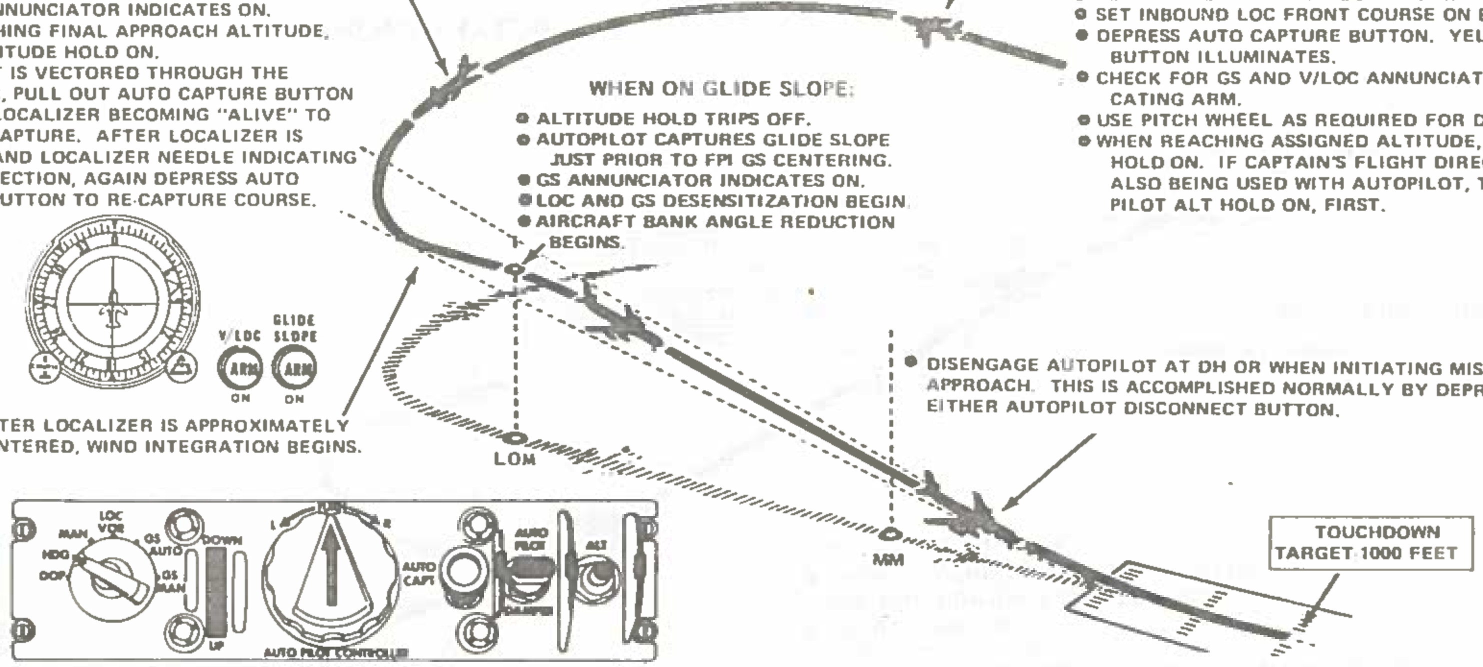
- MAINTAIN ASSIGNED HEADING.
- THREE SECONDS AFTER LOCALIZER NEEDLE "ALIVE", AIRCRAFT STARTS CAPTURE TURN.
- MODE SELECTOR RETURNS TO MANUAL. (AUTO CAPTURE BUTTON STAYS IN).
- LOC/VOR ANNUNCIATOR INDICATES ON.
- WHEN REACHING FINAL APPROACH ALTITUDE, PLACE ALTITUDE HOLD ON.
- IF AIRCRAFT IS VECTORED THROUGH THE LOCALIZER, PULL OUT AUTO CAPTURE BUTTON PRIOR TO LOCALIZER BECOMING "ALIVE" TO PREVENT CAPTURE. AFTER LOCALIZER IS CROSSED, AND LOCALIZER NEEDLE INDICATING FULL DEFLECTION, AGAIN DEPRESS AUTO CAPTURE BUTTON TO RE-CAPTURE COURSE.

WHEN RECEIVING INITIAL VECTORS

- ENGAGE AUTOPILOT. HDG MODE RECOMMENDED.
- IN HDG MODE, USE CAPTAIN'S FPI HDG KNOB TO FOLLOW ATC HEADINGS. IN MAN MODE, USE AUTOPILOT TURN CONTROLLER.
- SET ILS FREQUENCY ON BOTH VORs.
- SET INBOUND LOC FRONT COURSE ON BOTH FPIs.
- DEPRESS AUTO CAPTURE BUTTON. YELLOW BUTTON ILLUMINATES.
- CHECK FOR GS AND V/LOC ANNUNCIATORS INDICATING ARM.
- USE PITCH WHEEL AS REQUIRED FOR DESCENT.
- WHEN REACHING ASSIGNED ALTITUDE, PLACE ALT HOLD ON. IF CAPTAIN'S FLIGHT DIRECTOR IS ALSO BEING USED WITH AUTOPILOT, TURN AUTO PILOT ALT HOLD ON, FIRST.

WHEN ON GLIDE SLOPE:

- ALTITUDE HOLD TRIPS OFF.
- AUTOPILOT CAPTURES GLIDE SLOPE JUST PRIOR TO FPI GS CENTERING.
- GS ANNUNCIATOR INDICATES ON.
- LOC AND GS DESENSITIZATION BEGIN.
- AIRCRAFT BANK ANGLE REDUCTION BEGINS.



- AFTER LOCALIZER IS APPROXIMATELY CENTERED, WIND INTEGRATION BEGINS.

- DISENGAGE AUTOPILOT AT DH OR WHEN INITIATING MISSED APPROACH. THIS IS ACCOMPLISHED NORMALLY BY DEPRESSING EITHER AUTOPILOT DISCONNECT BUTTON.

IF HOLDING AT LOM

SELECT MAN MODE AND USE TURN CONTROLLER AS NEEDED WITH ALTITUDE HOLD ON OR HAND FLY WITH YAW DAMPER ON WHEN CLEARED FOR APPROACH:

(1) IF OUTBOUND, DEPRESS YELLOW BUTTON AND MAINTAIN HOLDING PATTERN, TURN INBOUND USING TURN CONTROLLER AND ROLL OUT TO INTERCEPT LOCALIZER.
(2) IF INBOUND AND BELOW GLIDE SLOPE, SELECT GS AUTO.
(3) IF INBOUND AND ON GLIDE SLOPE, SELECT GS MAN.

GENERAL INFORMATION

AUTOPILOT IS NOT APPROVED FOR BACK COURSE ILS APPROACH.

DURING AUTOPILOT USE, KEEP HAND CLOSE TO AUTOPILOT DISCONNECT BUTTON IN EVENT IMMEDIATE DISENGAGEMENT IS NECESSARY.

MONITOR CAPTAIN'S AND FIRST OFFICER'S INSTRUMENTS FOR POSSIBLE AUTOPILOT MALFUNCTIONS. A LOSS OF POWER TO THE AUTOPILOT'S NORMAL COMPASS AND RADIO SYSTEM WILL BE DETECTED BY A COMPASS, LOC OR GS FLAG APPEARING ON THE CAPTAIN'S FPI. IF A LOSS OF COMPASS OR RADIO SIGNALS OCCURS, THESE CAN BE RESTORED BY PLACING THE RESPECTIVE COMPASS SEL OR DEVIATION VOR SWITCH TO THE NO. 2 POSITION.

IF NECESSARY TO RESENSITIZE RADIO SIGNALS, WHILE AUTO CAPTURE BUTTON IS DEPRESSED, INITIALLY PLACE MODE SELECTOR TO GS MAN MODE. IF RESENSITIZATION IS LATER NEEDED, PLACE MODE SELECTOR TO LOC/VOR, THEN GS MAN. REPEAT AS NECESSARY DURING APPROACH, HOWEVER NOT AFTER REACHING LOM OR 1500 FEET ABOVE THE TERRAIN, WHICHEVER OCCURS FIRST.

AFTER LOCALIZER IS CAPTURED, USING AUTO CAPTURE BUTTON, IF TURN CONTROLLER IS MOVED, YELLOW BUTTON WILL POP OUT. IF THIS OCCURS, AND AIRCRAFT IS BELOW THE GLIDE SLOPE, SELECT GS AUTO TO RE-CAPTURE; IF ON GLIDE SLOPE, GS AUTO MODE WILL NOT ENGAGE - SELECT GS MAN.

GLIDE SLOPE CANNOT BE CAPTURED BEFORE LOCALIZER CAPTURE USING EITHER AUTO CAPTURE BUTTON OR GS AUTO MODE.

CAUTION SHOULD BE EXERCISED IF GS MAN IS SELECTED. GLIDE SLOPE AND LOCALIZER SHOULD BE APPROXIMATELY CENTERED PRIOR TO SELECTING THIS MODE.

* * *

F. AUTOPILOT ILS APPROACH-AUTO CAPTURE BUTTON

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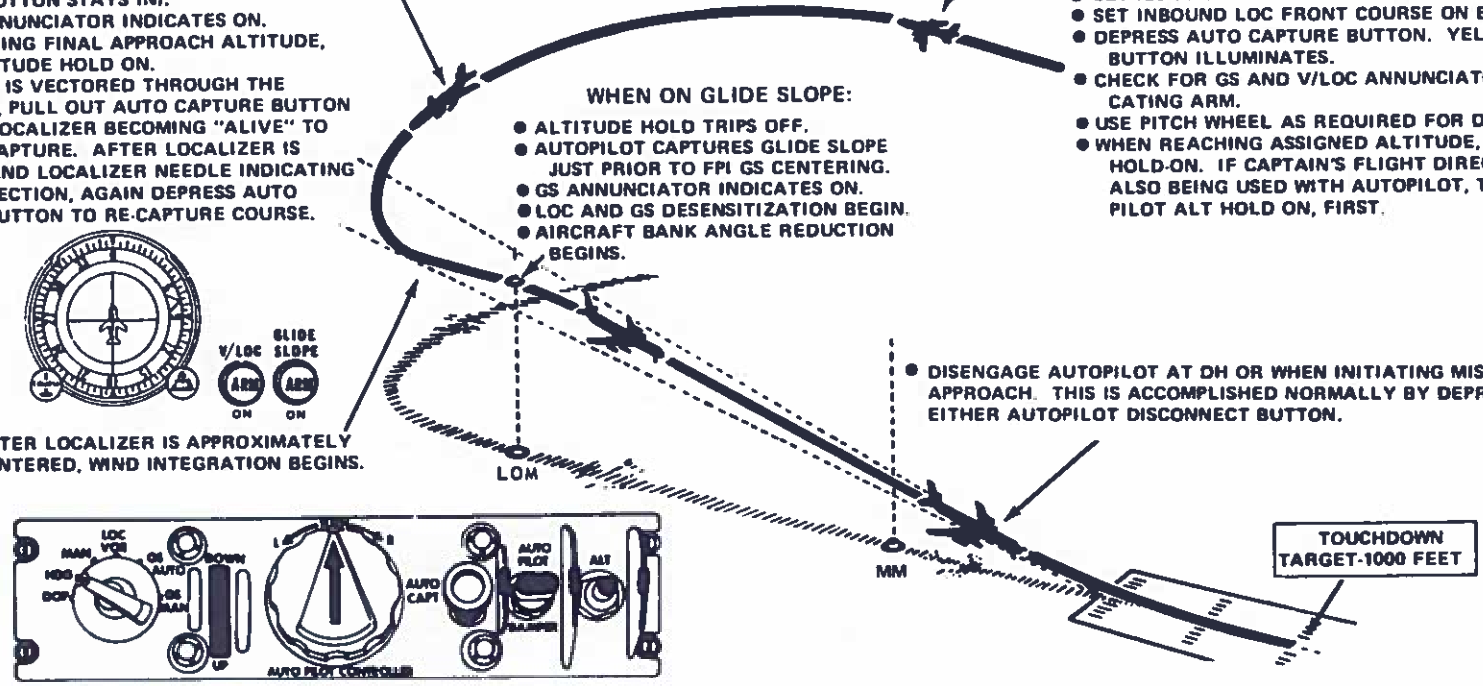

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IA92-255

TRANS WORLD AIRLINES

CONVAIR 880

FLIGHT HANDBOOK

FLIGHT OPERATIONS TRAINING DEPARTMENT

KANSAS CITY, MISSOURI

INTRODUCTION

This Flight Handbook contains information, limitations and procedures to be followed for safe and efficient operation of the TWA aircraft. Good judgment is expected in instances where the recommended procedure does not cover the situation.

This Handbook is the property of TWA and is not to be made available to persons or agencies not affiliated with TWA unless authorized. Refer to the TWA Management Policy and Procedure Manual for information regarding control of this publication.

ASSIGNMENT

Copies of this Handbook will be assigned during initial training. Assignment of additional or replacement copies and policy regarding crew member responsibilities relative to availability in flight are outlined in the TWA Flight Operations Policy Manual.

REVISIONS

Revisions are numbered and issued in consecutive order. Each revision includes a Transmittal page. The page includes a resume of major changes to aid in determining the extent or significance of the revised material. Transmittal pages are also used to control the deletion of teletype messages and operational bulletins obsoleted by inclusion of their subject material into the main body of this Handbook.

Yellow pages are used to describe system modifications or procedural changes planned for, but not yet applicable to, an entire fleet. When the change becomes standard, the appropriate white page is revised and the yellow page deleted.

The person to whom this Flight Handbook is assigned is responsible for keeping it current. Revised pages are to be inserted as soon as possible after they are received. A Transmittal Record page is provided and must be maintained.

REVISION SYMBOLS

↘ Indicates beginning of more than one line of revised or new material.

↗ Indicates end of more than one line of revised or new material.

→ Indicates only one line, or portion thereof, of revised or new material.

← Indicates deletion of material.

* * * Indicates end of section.

PAGE NUMBERING

Each page number is composed of three segments as described below:

00.00.01

Chapter Number — Section Number — Individual Page Number

Each page is also dated; the date is changed each time the content of the page is revised or altered.

INDEXING

Each chapter index shows all section and paragraph titles in the order they appear in the Handbook. A page date is provided for each page number to assist in checking for proper page content. New index pages are provided in revision transmittals when revised pages require subject titles to be rearranged. Index pages are also issued quarterly to update page dates for purposes of checking content. Requests for missing pages should be directed to: Publications, 1307 Baltimore, Kansas City, Missouri, 64105.

A separate tab and index are also provided for Flight Operations Training Bulletins currently applicable. The index is revised as bulletins are issued or deleted.

FORMAT

This Handbook is designed to meet the needs of the operating crew relative to preflight, inflight and post flight operations. Format and content is arranged so that each crew member can easily and quickly locate specific procedural coverage or necessary system information.

Material that is basic theory or of an initial training nature is omitted so that the operational portions of the aircraft systems can be more easily referenced.

Chapter 01, 02 and 03 contain the operating limitations, normal and emergency procedures. These chapters cover pertinent FAA Approved Flight Manual limitations, general and specific normal operating procedures, normal and emergency check lists together with their amplifications, and a listing of system specifications in quick reference form.

Chapters 04 through 11 cover operational information about the aircraft systems. Each of these chapters is arranged identically to aid in quickly locating needed data. The chapter index lists each separate procedure or illustration. The type of information found in each section of a chapter is outlined below:

Section .01 - Additional Procedures

Contains specific additional procedures, supplemental operating techniques for situations where normal complement of equipment is not available, useful system operational analysis methods and correction data needed to operate in an alternate mode.

Section .02 - Controls and Indicators

Provides illustrations of each general type of control and indicator related to systems covered in the chapter. Includes brief description of normal function of control. Shows specific nomenclature and location of the controlling electrical circuit protection.

AIRCRAFT PERFORMANCE

WEIGHTS

Maximum Taxi	185,000#
Maximum Brake Release	184,500#
Maximum Landing	155,000#
Maximum Zero Fuel	117,000#
Fleet Average Operating	See chapter 15 this handbook. 12,190

MAXIMUM AIRSPEEDS AND MACH NUMBERS

	Air Load Limit IAS-Knots	Buffet Limit Ind.-Mach
Maximum Operating Limit Speed (V_{mo} or M_{mo})	370 (S.L.)	Not Appl.
	390 (23,000 ft)	.88
Mach/airspeed warning bell approx. 23,000 ft. (V_{mo} + 3 kts - M_{mo} + .015 Mach)	393	.895
Landing gear limits		
Main gear only extended	375	M_{mo}
Nose gear extended	320	.83
Gear retraction	270	.70
Flap extension		
20°	245	.60
30°	235	.56
40°	215	.48
50°	195	.40
Maximum maneuvering	See graph chapter 01 this handbook.	
Stabilizer jammed in nose up condition (Spoiler selector switch in NOSE DOWN for trim).	245	.60
Speed stability system inoperative		
Emergency descent	375	.78
All other conditions	335	.73
Auto Pilot	V_{mo}	M_{mo}
Landing light extension	290	Not appl.
Fuel Jettison	V_{mo}	M_{mo}
Limiting Takeoff or landing tailwind	10 kts.	Not appl.
Crosswind Component	29 kts.	Not appl.

	Air Load Limit IAS - Knots	Buffet Limit Ind. - Mach
Windshield Anti-Fog System inoperative below 10,000 ft. pressure altitude or at any altitude where birds are likely to be encountered	300	Not appl.

MINIMUM AIRSPEEDS

IAS KTS at Max G.W. except where noted.

V_1, V_r and V_2	See G.W. Data section, 880 Planning and Performance Manual.
Best Angle of Climb - 2 or 3 Engine at Takeoff Thrust	V_2/V_{ref} + 50
En Route Climb - 2 or 3 Engines at Climb Thrust	See En Route Climb chart, chapter 01, this handbook.
Minimum missed approach speed, 4 or 3 engine (If IAS below, accelerate to)	145
Minimum approach speeds till landing assured:	
4 or 3 engine	Bug + 5 kts. but not less than V_{mca} (134)
2 engine	160
Boundary Speed (1.3 x V_{so}) at Landing Weight	154
Stalling Speeds - Power on or off	
Takeoff Weight - No Flaps	151
T.O. Weight -20° Flaps	142
Landing Weight - No Flaps	139
Landing Weight - 20° Flaps	131
Landing Weight - 30° Flaps	130
Landing Weight - 40° Flaps	129
Landing Weight - 50° Flaps	128

MINIMUM CONTROL SPEEDS

IAS KTS, Critical engine(s) inoperative, remaining engines at Takeoff thrust, S.L. and most critical temperature.

V_{mcg}	123
V_{mca}	134
V_{mca} (Two Engine)	159

DEPARTURE AND ARRIVAL SPEEDS

If the minimum safe airspeed for any particular operation is greater than the maximum speed prescribed in this paragraph, the aircraft may be operated at that minimum speed.

Airport traffic area or beneath lateral limits of terminal control area	200 kts.
Below 10,000 ft. altitude	250 kts.

RCRAFT PERFORMANCE (Cont'd)

LIMB AIRSPEED	350 kts. IAS till attaining 0.80 Mach then maintain 0.80 Mach.
URBULENCE TARGET SPEED	280 IAS/Mach .80 - .84
AXIMUM TEMPERATURE FOR TAKEOFF OR LANDING	S.L. to 2500 ft. - 120°F Above 2500 ft. - See temperature limit graph, section 01.07 this handbook.
AXIMUM CERTIFICATED AIRCRAFT ALTITUDE	41,000 ft.

IGINE LIMITATIONS (Max. Limit Unless Otherwise Noted)

ngine thrust rating, Sea Level, standard day, no air bleed or ower extraction.

Takeoff static thrust, lbs.	11,200
Takeoff thrust time limitation, minutes	5

GT, RPM - TYPE 1 CONDITION

EGT °C.

Starting	550
Takeoff (5 minutes)	632
Climb (Continuous)	560
Cruise	535
RPM %	103

NOTE

Whenever a TYPE 1 limit is exceeded:

Flight conditions permitting, retard the throttle below the limit.

Note in the logbook the highest indicated value and the approximate time (in seconds) engine was operated above the limit. Maintenance action required at destination whenever a TYPE 1 limit has been exceeded.

EGT, RPM - TYPE 2 CONDITION

EGT °C.

Starting	660 or 600 for 25 secs.
Takeoff	650 for 15 secs.
RPM%	107 or 105 for 5 secs.

NOTE

Whenever a TYPE 2 limit is exceeded:

Flight conditions permitting, use the engine failure procedure. Continued engine operation at idle only is permitted if it is imperative that electrical or hydraulic power is required.

Note in the logbook the highest indicated value and the approximate time (in seconds) engine was operated above the limit.

If during engine starting an engine exceeds a TYPE 2 condition, shut the engine down.

OIL SYSTEM

NORMAL SERVICE LEVEL INDICATED QUANTITY	3.0 gals.
MINIMUM INDICATED QUANTITY BEFORE ENGINE START	2.5 gals.
MAXIMUM ALLOWABLE OIL CONSUMPTION RATE	1 quart/hr.
MAXIMUM OIL TEMPERATURE	149°C
OIL PRESSURE LIMITATIONS	See chart section 02.76
OIL PRESSURE WARNING LIGHT ON @	12 PSI or below
OIL PRESSURE DURING STARTING	Positive indication within 30 secs. of engine rotation

FUEL SYSTEM

(All weights based on 6.7 LBS/GAL.)

FUEL GRADE	Contact Nearest TWA Dispatch office for approved fuel listing.
FUEL TANK CAPACITIES (Usable Fuel)	LBS
1 & 4 Replenish each	4,140
1 & 4 Main each	11,685
2 & 3 Replenish each	9,388
2 & 3 Main each	10,578
Total	71,582
FUEL TEMP	
At Engine	0°C to +71°C
At Fuel Tank	-40°C to +54°C
FUEL JETTISON RATE	805 Lbs/Min/Tank
RESIDUAL FUEL AFTER COMPLETE JETTISONING	11,390 Lbs.
FAA RESERVE	5,000 Lbs.
TWA RESERVE	2,000 Lbs.

FUEL SYSTEM (Cont'd)

TAXI FUEL	1,000 Lbs.

NOTE
ORD (1600-1800 local time) and JFK, add 500 Lbs.

AIR CONDITIONING AND PRESSURIZATION

TURBOCOMPRESSOR

Speed	(RPM)
Normal Maximum	49,000
Maximum Allowable (Manual Shutdown)	51,000
Overspeed Trip Approx.	55,000

CABIN PRESSURE CONTROL

Cabin Altitude Warning Horn and High Alt. Light on above	10,000 feet
Automatic Controller Control Limit	8.3 PSI
Pressure Regulator (outflow valve) Functions	
Electric Relief	8.1 PSI
Emergency Pneumatic Relief	8.5 PSI
Altitude Limit Control (AUTO)	13,000 ± 2,000 ft.
MANUAL TEMP. CONTROL DUCT LIMIT SWITCHES MAXIMUM	160°F
MAX. EVAPORATOR AIR IN TEMP. WHEN ALTERNATE PRESSURIZATION SOURCE IS USED	140°F

HYDRAULIC SYSTEM

SYSTEM PRESSURE #1 and #2	3000 +100 -300 PSI

FLUID QUANTITY (SYSTEMS PRESSURIZED)

Cockpit Gauges #1	Cockpit Gauges #2	Sight Gauge
1.5 Gal.	4.5 Gal.	FULL
1.0 Gal.	3.2 Gal	REFILL (Min Dispatch)

AUXILIARY PUMP PRESSURE	1900 PSI (MIN)
HIGH PRESS. SYSTEM REL. VALVE	3500 ± 100 PSI
MAXIMUM FLUID TEMP	80°C
ENGINE PUMP LOW PRESS WARNING - Approx.	1250 PSI
ENGINE PUMP PRESSURE MIN.	2700 PSI
SYSTEM ACCUM. PRELOAD (#1 and #2)	900 PSI
BRAKE ACCUM. PRELOAD	900 PSI
GEAR ACCUM. PRELOAD	900 PSI
MLG BRAKE MODULATOR ACCUM. PRELOAD	300 PSI
NOSE BRAKE MODULATOR ACCUM PRELOAD	200 PSI

EMERGENCY AIR BRAKE BOTTLE

Full Charge	3000 PSI
Minimum Dispatch	1600 PSI

PASSENGER WATER SYSTEM

Tank Service Capacity	50 Gallons

OXYGEN SYSTEM (PSI@70°F BOTTLE TEMP)

NORMAL PRESSURE PER BOTTLE	1800 PSI
CREW - MINIMUM FOR TAKEOFF - PER BOTTLE	
Fixed	900 PSI
Portable	1750 PSI
PASSENGER - MINIMUM FOR TAKEOFF - PER BOTTLE	
Fixed	1250 PSI
Portable	1750 PSI

OXYGEN AVAILABLE - MINUTES AT MINIMUM DISPATCH BOTTLE PRESS @ 14,000' CABIN ALT. BASED ON COCKPIT CREW OF 4 AND CABIN CREW OF 4.

Cockpit Crew on Normal (Supplemental Mask)	134 MINUTES
Cockpit Crew on 100% (Supplemental Mask)	17 MINUTES
Cockpit Crew on Emergency (Supplemental Mask)	14 MINUTES
Cockpit Walk-Around Bottle	14 MINUTES
Cabin Walk-Around Bottles (Supplemental Outlet) each	146 MINUTES
Flight Attendants plus 100% Passengers	25 MINUTES

DE-ICING AND ANTI-ICING

LEADING EDGE AND DUCT SPACE TEMP. EXCESS HEAT LIGHT ON.

WING ANTI-ICING TEMP. (Skin Patch Sensor) -	350°F
WING DUCT SPACE TEMP	300°F
FUS DUCT SPACE TEMP	150°F

TEMPERATURE RANGE FOR USE OF ENGINE ANTI-ICE IF VISIBLE MOISTURE IS PRESENT.

Takeoff	41°F and Below
In Flight (RAT)	-15°C to +5°C

.ECTRICAL SYSTEM

)NSTANT SPEED DRIVE

Operating RPM Range (For 400 CPS) Idle or Above

Under Speed Switch Operates (CPS) 350 to 385 CPS

C. GENERATOR

Voltage	115 ± 2 Volts
Frequency	400 ± 4 CPS
Power - KW/Amps	
Continuous	36 KW/111 amps
Five minute overload	50 KW/150 amps

Off scale readings, other than momentary surges, require immediate load reduction.

'TERNAL POWER (Prior to connecting to Sync. Bus)

Voltage	115 ± 4 Volts
Frequency	400 ± 9 CPS

C. POWER

Battery

Rating	13.5 amp/hr.
Voltage	22 - 34 volts

Main T-R Units

Voltage	24-28 Volts
Rating	50 amps

ERGENCY EQUIPMENT

ACUATION SLIDE

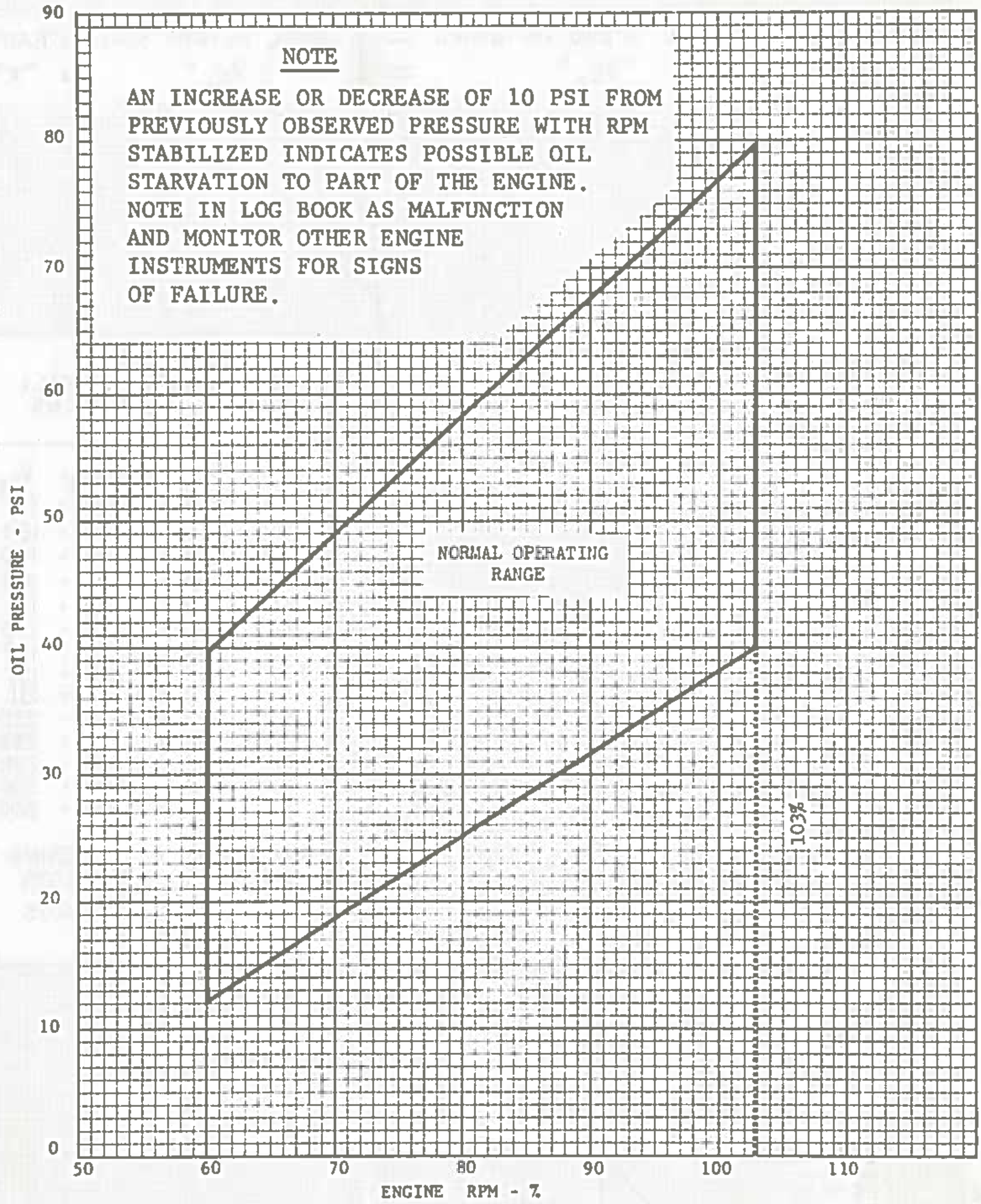
ıimum Cylinder Air Pressures are as follows:

Bottle Temp @ 32°F	2400 PSI
Bottle Temp @ 80°F	2800 PSI

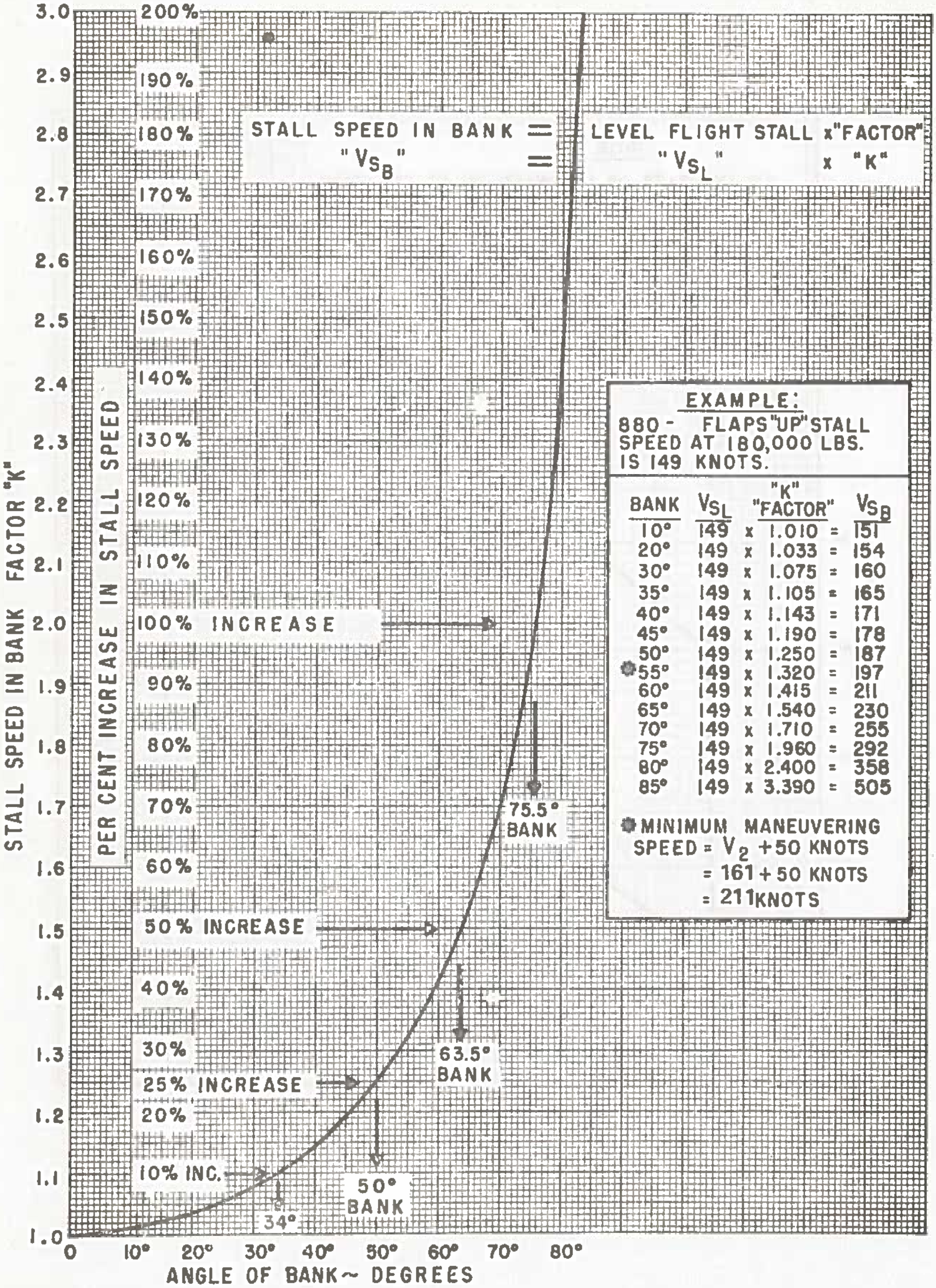
(Interpolate for other temperatures)

* * *

OIL PRESSURE ENVELOPE GRAPH



ALL SPEED VS. BANK ANGLE



EXAMPLE:

880 - FLAPS "UP" STALL SPEED AT 180,000 LBS. IS 149 KNOTS.

BANK	V_{S_L}		"K" "FACTOR"		V_{S_B}
10°	149	x	1.010	=	151
20°	149	x	1.033	=	154
30°	149	x	1.075	=	160
35°	149	x	1.105	=	165
40°	149	x	1.143	=	171
45°	149	x	1.190	=	178
50°	149	x	1.250	=	187
✱55°	149	x	1.320	=	197
60°	149	x	1.415	=	211
65°	149	x	1.540	=	230
70°	149	x	1.710	=	255
75°	149	x	1.960	=	292
80°	149	x	2.400	=	358
85°	149	x	3.390	=	505

✱ MINIMUM MANEUVERING SPEED = V_2 +50 KNOTS
= 161 + 50 KNOTS
= 211 KNOTS

* * *

* * *

A. GENERAL

1. The emergency procedures in this Handbook represent the best known available facts about the subjects. Flight crews should follow these procedures as long as they fit the emergency. At any time they are not adequate or do not apply, the flight crew's best judgement should prevail. Safe altitude and airspeed should always be of primary concern.

2. Emergency procedures are covered by the following methods:

   a. Emergency Check List (See Section. 03. 05)
   Items on this list are amplified, where clarification is necessary, in Section 03. 10 of this Handbook. The amplification must be checked, following accomplishment of the check list, for secondary procedures and information relative to the emergency.

   b. Other Emergencies Guide Check List (See Section 03. 07)
   Items on this list are amplified, where necessary, in Section 03. 12 of this Handbook. Always check the amplification, following accomplishment of the check list, for additional information about the procedure.

   c. Emergency Procedures NOT ON Check Lists
   Advisory type procedures and procedures not requiring immediate crew action are not included on the check lists. These procedures are covered in Section 03. 12, this Handbook, following the amplification of the Other Guide check list items.

3. All flight crews must be thoroughly familiar with emergency procedures and with the location and use of emergency equipment.

B. USE OF EMERGENCY CHECK LIST

1. After the initial steps toward combatting the emergency have been completed, i. e., memory (boxed) items, the Captain shall call for and designate who is to read the Emergency Check List. It is imperative that the entire check list for the particular emergency be completed without delay since failure to do so may reduce capability to handle the emergency or may even compound it.

   The challenge contains the control and its correct position. The crew member reading the check list shall read only the challenge. The crew member responsible for positioning the pertinent control shall answer with the response after making certain that it is properly positioned. For example, the challenge "Throttle Close" will be answered "Close."

2. The person reading the check list will advise the Captain when the check list is complete.

C. ALL EMERGENCIES

1. Report position and nature of emergency. The decision as to best descent procedure or whether descent is necessary or not, will depend upon the nature of the emergency, weather conditions, terrain and any possible structural weakness in the aircraft caused by the emergency. Only the flight crew can evaluate the emergency sufficiently to make the proper decisions.

2. Time permitting, the Captain should secure such technical information and assistance as may be available, via radio, from maintenance and engineering personnel.

3. In an emergency which involves smoke, fumes, rapid loss of cabin pressure, etc., oxygen must be used and interphone communications set up immediately. When the degree of emergency has been determined, the continued use of oxygen will be dictated by the existing circumstances.

4. Prepare for emergency descent and landing by determining the position of the nearest landing field and the best method of descent dependent upon the circumstances of the emergency.

5. Fires are the most urgent emergencies and require immediate action in the earliest stages for proper control. Whenever fire or smoke is reported or suspected, thorough investigation must be made. In all cases of fire warnings, it must be assumed that a fire exists until proven otherwise.

6. Experience has shown that serious damage to the aircraft can be incurred on the ground with very little indication to the cockpit crew. Be suspicious of any indication and, if there is any question as to aircraft damage:

   a. Stop the aircraft.

   b. Start levers OFF.

   c. Pull all Fire Controls.

   d. Discharge the Fire Extinguishers to each engine.

   e. Immediately determine the need for passenger evacuation.

D. SILENCING AURAL WARNINGS

Silence the aural warning(s) promptly to improve crew coordination during emergency conditions.

1. Fire Warning Bell
The Captain or First Officer will silence any fire bell after noting fire warning light indication. When First Officer silences the bell he will advise the Captain "Bell Off."

2. Landing Gear Warning Horn
When a throttle or throttles are closed, the First Officer or Engineer should silence the gear warning horn as soon as possible.

3. Cabin Pressure Warning Horn
A loss of cabin pressure will cause an intermittent warning horn to sound if the loss progresses. If the cabin pressure warning sounds, the Flight Engineer should silence the horn and advise the Captain "Cabin Altitude Horn Off."

E. COCKPIT TO CABIN CHIME SIGNALS

To alert the cabin attendants that certain conditions exist requiring their attention, the following chime signals shall be used.

1. Three Single Tone Chimes - Summon Cabin Attendant to cockpit or contact cockpit on interphone.

2. Four Single Tone Chimes - Alert to cabin attendants takeoff is imminent and to assume takeoff positions immediately. Also, turbulence is expected. Cabin attendants to fasten seat belts immediately.

3. Six Single Tone Chimes - An emergency situation exists. "A" C/A to report to cockpit immediately.

* * *

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EMERGENCY 880 CHECK LIST

REPORT POSITION AND NATURE OF EMERGENCY AS SOON AS PRACTICAL. CONSIDER REQUIREMENT FOR DESCENT AND LANDING. AFTER COMPLETION OF CHECK LIST, REFER TO THE APPLICABLE FLIGHT HANDBOOK AMPLIFICATION.

ENGINE FAILURE 03.10.01

1. THROTTLE CLOSE .... CLOSE

2. YAW DAMPER OFF .... OFF
3. WHEN ENGINE AT IDLE, START LEVER OFF .... OFF
4. FIRE CONTROL PULL .... PULL
5. ANTI-ICE CHECK .... CHECK
6. ELECTRICAL POWER CHECK .... CHECK
7. HYDRAULIC POWER CHECK .... CHECK

ENGINE FIRE/OVERHEAT 03.10.01

1. THROTTLE CLOSE .... CLOSE
2. WING ISOLATION SWITCH OFF .... OFF

3. YAW DAMPER OFF .... OFF
4. WHEN ENGINE AT IDLE & WARNING PERSISTS, START LEVER OFF .... OFF
5. AT MINIMUM RPM & WARNING PERSISTS, FIRE CONTROL PULL .... PULL
6. FIRE EXTINGUISHER DISCHARGE .... DISCHARGE
7. IF VISIBLE FIRE EXISTS, DISCHARGE SECOND CHARGE IMMEDIATELY.
8. IF WARNING PERSISTS AFTER 30 SECONDS, DISCHARGE SECOND CHARGE.
9. IF WARNING PERSISTS, ACCELERATE TO V_{mo}.
10. IF WARNING PERSISTS, PROCEED TO NEAREST SUITABLE AIRPORT.
11. ANTI-ICE CHECK .... CHECK
12. WING ISOLATION CHECK .... CHECK
13. ELECTRICAL POWER CHECK .... CHECK
14. HYDRAULIC POWER CHECK .... CHECK

ENGINE FLIGHT START 03.10.02

1. START LEVER OFF .... OFF
2. THROTTLE CLOSE .... CLOSE
3. WINDMILLING RPM CHECK .... CHECK
4. FIRE CONTROL IN .... IN
5. LINE VALVE OPEN .... OPEN
6. BOOST PUMPS ON .... ON
7. START SWITCH FLIGHT .... FLIGHT
8. START LEVER RUN .... RUN
9. ENGINE AT IDLE, START SWITCH OFF ..... OFF
10. ELECTRICAL POWER CHECK .... CHECK

A.C. POWER LOSS 03.10.03

1. BATTERY SWITCH EMERGENCY ..... EMERGENCY
2. CROSSFEED VALVES CLOSE .... CLOSE
3. EQUIPMENT COOLING FAN ON .... FAN ON
4. GENERATOR LINE RELAYS OPEN .... OPEN
5. ANY POSSIBLE FIELD RELAY CLOSE ..... CLOSE
6. PILOT ESS BUS ON OPERATING GENERATOR .... CHECK
7. IF CABIN ALTITUDE INCREASING:
   a. BATTERY SWITCH NORMAL .... NORMAL
   b. PRESSURIZATION CHECK .... CHECK
8. FREON PACKS OFF .... OFF
9. RECIRC FAN OFF .... OFF
10. ALL BUS TIE SWITCHES OPEN .... OPEN
11. ALL POSSIBLE FIELD & LINE RELAYS CLOSE .... CLOSE
12. CLOSE BUS TIE RELAYS ONLY TO POWER REQUIRED BUSSES.

ELECTRICAL FIRE 03.10.03

1. PROTECTIVE OXYGEN & INTERPHONE ON .. ON
2. OXYGEN REGULATORS, ALL LEVERS UP .... UP
3. PILOT ESS BUS ON OPERATING GENERATOR .... CHECK
4. CROSSFEED VALVES CLOSE .... CLOSE
5. RECIRC FAN OFF .... OFF
6. GENERATOR LINE RELAYS OPEN .... OPEN
7. AC POWER SWITCH STANDBY .... STANDBY
8. BATTERY SWITCH EMERGENCY ... EMERGENCY
9. IF PILOT ESS POWER ABNORMAL:
   a. FREON PACKS OFF .... OFF
   b. BATTERY SWITCH NORMAL .... NORMAL
   c. ALL BUS TIE SWITCHES OPEN ...... OPEN
   d. NO. 3 BUS POWERED .... POWERED
   e COMPASS & DEVIATION SELECTORS NO. 2 .... NO. 2
   f. AC POWER SWITCH MAIN .... MAIN
   g. PILOTS ESS BUS ON EXTERNAL PWR .... EXT PWR
10. IF PILOT ESS POWER NORMAL, OPEN EMER DC & PILOT ESS CIRCUIT BREAKERS NOT REQ'D.
11. IF CONDITION PERSISTS, OPEN FIELD RELAYS NOT REQUIRED.
12. REVIEW EFFECT OF INOPERATIVE CIRCUITS.

AIR CONDITIONING SMOKE 03.10.04

1. PROTECTIVE OXYGEN & INTERPHONE ON ..... ON
2. OXYGEN REGULATORS, ALL LEVERS UP ...... UP
3. RECIRC FAN OFF .... OFF
4. BOTH D.C. BUSSES (ESS & EMER) POWERED .... POWERED
5. ALTERNATE PRESSURE SOURCES OPEN ..... OPEN
6. TURBOCOMPRESSORS OFF .... OFF

SMOKE REMOVAL 03.10.04

1. RECIRC FAN OFF .... OFF
2. TURBOCOMPRESSORS ON .... ON
3. ALTERNATE PRESSURE SOURCES OPEN ..... OPEN
4. SELECT 10, 000 FT. CABIN ALTITUDE ..... CHECK
5. RATE CONTROL FULL INCREASE .... FULL INC
6. COCKPIT AIR SHUTOFFS OPEN .... OPEN
7. IF PRESSURIZING AIR SOURCE NOT AVAILABLE:
   a. RAM AIR SOURCE OPEN .... OPEN
   b. PRESSURE REGULATORS MANUALLY OPEN .... OPEN

TRANS WORLD AIRLINES

CONVAIR 880

FLIGHT HANDBOOK

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EMERGENCY 880 CHECK LIST

–CABIN PRESSURE LOSS 03.10.05

1. OXYGEN MASK & INTERPHONE ON .... ON
2. WHEN AIRCRAFT ABOVE 14,000 FEET, INITIATE RAPID DESCENT IF PRACTICAL.
3. AIR SOURCES CHECK .... CHECK
4. PRESSURE REGULATORS CLOSE .... CLOSE
5. EQUIPMENT COOLING FAN ON .... FAN ON
6. RECIRC FAN OFF .... OFF
7. FREON SELECTOR BOTH ON.......... BOTH ON
8. IF CABIN ALTITUDE ABOVE 30,000 FEET, OXYGEN REGULATORS, ALL LEVERS UP ...... UP
9. PASSENGER OXYGEN CHECK .... CHECK

–ANTICIPATED CRASH LANDING/DITCHING 03.10.06

1. WHEN TIME PERMITS, REVIEW AMPLIFIED PROCEDURES CHAPTER 03, FLIGHT HANDBOOK.
2. BATTERY SWITCH EMERGENCY ..... EMERGENCY
3. SHOULDER & SEAT BELTS SECURE...... SECURE
4. LANDING GEAR:
   - a. LANDING-GEAR DOWN .... DOWN
   - b. DITCHING-GEAR UP .... UP
     - (1) PULL WARN HORN CIRCUIT BRKR C8.
5. WING FLAPS 50° ....50°
6. EMERGENCY EXIT LIGHTS ON .... ON
7. WHEN READY TO SECURE ENGINES, START LEVERS OFF .... OFF
8. WHEN AIRCRAFT STOPS, PLACE SPOILER SPEED BRAKE HANDLE DOWN, PULL FIRE CONTROLS, & DISCHARGE MAIN EXTINGUISHERS.

–RAPID DESCENT 03.10.05

1. THROTTLES CLOSE .... CLOSE
2. WHEN STRUCTURAL DAMAGE SUSPECTED, AVOID HIGH IAS & ABRUPT MANEUVERING.
3. SPOILER SPEED BRAKE UP .... UP
4. AUTOPILOT OFF .... OFF
5. LANDING GEAR DRAG BRAKE (375 KTS MAX IAS) DOWN ....DOWN
6. DESCENT TARGETS:
   - a. BODY ANGLE MAXIMUM 15° DOWN.
   - b. 355 KTS IAS (375 KTS MAX IAS).

–FUEL DUMPING 03.10.07

1. JETTISON SWITCHES (3220 LB/MIN TOTAL) OPEN .... OPEN
2. REPLENISH PUMPS ON .... ON
3. IF No. 2 & No. 3 TANK SCAVENGE DESIRED:
   - a. CROSSFEED VALVES OPEN .... OPEN
   - b. No. 1 & No. 4 BOOST & TRANSFER PUMPS ON .... ON
   - c. SCAVENGE SWITCHES (1610 LB/MIN TOTAL) OPEN .... OPEN
   - d. No. 2 & No. 3 MAIN TRANSFER PUMPS ON. .ON
4. MONITOR HYD SYSTEMS & FUEL QUANTITY.
5. WHEN DUMPING COMPLETE, JETTISON & SCAVENGE SWITCHES CLOSE .... CLOSE
6. STANDPIPE FUEL REMAINING:
   - JETTISON ONLY .... 11,390 LBS
   - JETTISON & SCAVENGE DRY........ 6,030 LBS

–RUNAWAY STABILIZER 03.10.06

A. NORMAL SYSTEM:
1. STOP NORMAL TRIM WHEEL BY HAND.
2. STAB TRIM HYD SHUTOFF SWITCH CLOSE .... CLOSE
3. STAB TRIM CONT CIRCUIT BRKR B9 PULL ...PULL
4. EMER STAB TRIM CONT CIRCUIT BRKR B9 IN ..IN
5. USE STANDBY TRIM SYSTEM

B. STANDBY SYSTEM:
1. DO NOT ATTEMPT TO STOP EMER TRIM WHEEL BY HAND.
2. STAB TRIM HYD SHUTOFF SWITCH OPEN.... OPEN
3. No. 1 & No. 2 HYDRAULIC PUMPS OFF ..... OFF
4. USE EMER TRIM WHEEL FOR TRIM.

–BRAKE FIRE/SMOKE 03.10.08

1. STOP AIRCRAFT.
2. ALERT EMERGENCY EQUIPMENT.
3. CONFIRM NATURE OF REPORTED BRAKE PROBLEM.
4. IF FIRE VISIBLE:
   - a. PARK BRAKES.
   - b. SHUT DOWN ENGINES.
   - c. EVALUATE NEED TO EVACUATE.
5. IF EXCESSIVE SMOKE APPARENT:
   - a. TURN NOSE WHEEL FULL TRAVEL TO PREVENT ROLLING.
   - b. LEAVE BRAKES OFF.
   - c. MONITOR GEAR FOR INDICATIONS OF FIRE.

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880 OTHER EMERGENCIES GUIDE

AFTER COMPLETING PROCEDURE, REFER TO 03.12 OF THE FLIGHT HANDBOOK

TWO ENGINE PROCEDURE

APPROACH

1. CHECK MAX GROSS WEIGHT TABLE IN 03.12 OF FLIGHT HANDBOOK
2. COMPLETE PRELIMINARY CHECK LIST
3. REVIEW MISSED APPROACH PROCEDURE
4. FLAPS 20°
5. MINIMUM SPEED, BUG + 30 KTS BUT NOT LESS THAN 160 KTS
6. AUXILIARY HYDRAULIC PUMP ON
7. INTERCEPTING APPROACH SLOT, GEAR DOWN
8. COMPLETE FINAL CHECK LIST
9. TURNING FINAL, REDUCE TO BUG + 30 KTS BUT NOT LESS THAN 160 KTS
10. AT COMMIT POINT (APPROX 400 FT), FLAPS 30°
11. START SPEED BLEED
12. UPON REACHING POSITION WHERE FIELD CAN BE MADE WITH IDLE THRUST:
    a. FLAPS 50°
    b. BLEED SPEED TOWARD BUG + 5 KTS

MISSED APPROACH

1. APPLY TAKEOFF THRUST, CHECK DESCENT & KEEP BALL NEARLY CENTERED
2. AT MINIMUM OF BUG + 30 KTS & ACCELERATING, RETRACT FLAPS & GEAR
3. ACCELERATE TO BUG + 50 KTS & THEN CLIMB TO MEA
4. PERFORMANCE PERMITTING, USE CLIMB THRUST

NO FLAP PROCEDURE

1. COMPLETE PRELIMINARY CHECK LIST
2. SET BUG TO V_{ref} + 25 KTS
3. GEAR DOWN
4. COMPLETE FINAL CHECK LIST
5. MINIMUM MANEUVERING, BUG + 25 KTS
6. USE NORMAL APPROACH SLOT. REDUCE TO BUG ON FINAL.

WINDOW
ARCING/CRACKED/OVERHEAT

1. AFFECTED WINDOW HEAT SWITCH OFF . . . OFF
2. CHECK WINDOW CONDITION:
   a. SINGLE LAYER CRACKED, NO PRESS REDUCTION
   b. MULTIPLE LAYERS CRACKED, 5 PSI MAX
3. AFFECTED WINDOW CB (B5) PULL . . . . PULL
4. BELOW 10,000 FT, 300 KTS MAX.

JAMMED STABILIZER PROCEDURE

(ASSUMES NOSE UP TRIM REQUIREMENT)

APPROACH

1. SELECT NOSE UP WITH SPOILER SEL SWITCH
2. TRIM WITH SPEED BRAKE HANDLE
3. COMPLETE PRELIMINARY CHECK LIST
4. SET BUG TO V_{ref} + 10 KTS
5. REVIEW MISSED APPROACH PROCEDURE
6. REDUCE SPEED, FLAPS 30°
7. GEAR DOWN
8. COMPLETE FINAL CHECK LIST
9. FLAPS 40°
10. ESTABLISH NORMAL DESCENT RATE AT BUG SPEED
11. EVALUATE FLARE CAPABILITY
12. INCREASE TO BUG + 10 KTS FOR MANEUVERING
13. REDUCE TO BUG ON FINAL & MAKE NORMAL APPROACH
14. WHEN FLARE IS STARTED, FLAPS 50°

MISSED APPROACH

1. APPLY TAKEOFF THRUST & ROTATE
2. RETRACT FLAPS TO 30°
3. WITH POSITIVE RATE OF CLIMB, RETRACT GEAR
4. TRIM WITH SPEED BRAKE HANDLE

GEAR LEVER LOCKED

(TRUCK LIGHT OUT)

1. IF GREATER EMERGENCY EXISTS, OVERRIDE LEVER LOCK & RETRACT GEAR
2. NOSE STEERING WHEEL NEUTRAL CHECK . . . . CHECK
3. IF WHEEL DOES NOT REMAIN IN NEUTRAL, DO NOT RETRACT GEAR
4. WITH WHEEL NEUTRAL & LEVER LOCKED:
   a. BOTH LDG GEAR GRD SAFETY SW CB's (C8) PULL . . . . PULL
   b. OVERRIDE LOCK & RETRACT GEAR
5. JUST AFTER TOUCHDOWN, RESET SAFETY SW CB's

GEAR TRUCK LIGHT ON

1. IF GREATER EMERGENCY EXISTS, OVERRIDE LEVER LOCK & RETRACT GEAR
2. IF LEVER NOT LOCKED, RETRACT GEAR
3. IF LEVER LOCKED, DO NOT RETRACT GEAR

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880 OTHER EMERGENCIES GUIDE

HYDRAULIC PUMP FAILURE

1. FAILED PUMP INLET CLOSED . . . INLET CLOSED

HYDRAULIC FLUID LOSS

1. AFFECTED SYSTEM PUMPS INLET CLOSE . . . . INLET CLOSED
2. IF LOSS CONTINUES, BOTH PUMPS OFF . . . OFF
3. IF LOSS STOPS, RETURN PUMPS ONE AT A TIME TO OFF & CHECK QUANTITY
4. SEE 03.12 FOR SYSTEM RESTORATION PROCEDURES

HYDRAULIC FLUID OVERHEAT

1. AFTER GEAR & FLAPS UP, AFFECTED SYSTEM PUMPS OFF . . . . OFF
2. RESTORE SYSTEM ON APPROACH

MANUAL GEAR EXTENSION

1. 170 - 320 KTS CHECK . . . . CHECK
2. AFFECTED GEAR EMERGENCY RELEASE LATCHED DOWN . . . . LATCHED DOWN
3. WHEN AFFECTED GEAR INDICATES DOWN, GEAR LEVER DOWN . . . . DOWN
4. GEAR INDICATOR LIGHTS CHECK . . . . . . CHECK
5. BRAKE PRESSURES CHECK . . . . CHECK
6. IF GEAR NOT DOWN, SEE 03.12 FOR SUPPLEMENTAL EXTENSION SYSTEM PROCEDURE.

ALTERNATE BRAKING

1. AFTER NO. 2 HYDRAULIC SYSTEM FAILURE, BRAKE PRESSURE CHECK . . . . CHECK
2. AFTER TOUCHDOWN:
   a. NO. 3, NO. 4 & AUX HYDRAULIC PUMPS ON
   b. USE ONE TOE BRAKE APPLICATION TO STOP AIRCRAFT
3. IF TOE BRAKES INEFFECTIVE:
   a. RELEASE TOE BRAKES
   b. METER AIR BRAKES AS REQUIRED.

CSD MALFUNCTION LIGHT

1. IF ANY GENERATOR RELAY LIGHT ON, DISCONNECT . . . . DISCONNECT
2. IF NO GENERATOR RELAY LIGHT ON:
   a. FIELD SWITCH TEST.
   b. CHECK FREQUENCY
   c. IF FREQUENCY ABNORMAL, DISCONNECT . . . . DISCONNECT
   d. IF FREQUENCY NORMAL, MONITOR GENERATOR CONDITION.
3. IF MALFUNCTION LIGHT REMAINS ON FOR ONE MINUTE, DISCONNECT . . . . DISCONNECT

GENERATOR OVERHEAT LIGHT

1. FIELD SWITCH OFF . . . . OFF
2. IF OVERHEAT LIGHT GOES OUT:
   a. LINE SWITCH OPEN . . . . OPEN
   b. FIELD SWITCH ON . . . . ON
   c. MONITOR GENERATOR CONDITION
3. IF OVERHEAT LIGHT REMAINS ON FOR ONE MINUTE, DISCONNECT . . . . DISCONNECT

* * *

ENGINE FAILURE

When any crew member recognizes an engine failure condition, advise the captain "Engine Failure." Do not identify the problem engine during the advisory because the captain's attention must be directed to controlling the aircraft.

Regardless of whether the failure occurs during takeoff or while en route, use the following procedure for shutdown to minimize damage to the engine and accessories.

1. THROTTLE CLOSE . . . . CLOSE

   Smoothly close throttle and allow engine to decelerate to stabilized idle RPM. If a thorough evaluation has not been made of vibration tendencies or other reasons that have prompted the decision to shut down, a few moments spent in analysis of the situation may prove helpful in describing the malfunction to Technical Services.

2. YAW DAMPER OFF. . . . . OFF

   Disengage the Yaw Damper/Autopilot until any necessary trimming of the aircraft has been accomplished. The Yaw Damper/Autopilot may be re-engaged after the aircraft is in trim.

3. WHEN ENGINE AT IDLE, START LEVER OFF . . . OFF

   Place start lever Off when engine has stabilized at idle RPM and monitor EGT for indication of a clean shutdown.

4. FIRE CONTROL PULL . . . . PULL

   This is necessary to shut off the flow of fuel in the pylon if a severed fuel line occurred during an engine failure or has caused the engine failure.

5. ANTI-ICE CHECK . . . . CHECK

   Turn off engine anti-ice on the inoperative engine. Observe bleed air limits in Chapter 01.05 this handbook.

6. ELECTRICAL POWER CHECK . . . . CHECK

   Check for excessive generator loads and make load reduction as necessary.

7. HYDRAULIC POWER CHECK . . . . CHECK

   Check that both hydraulic systems are pressurized.

ENGINE FIRE/OVERHEAT

Although any engine fire/overheat or failure is serious, it does not require immediate shutdown. This is particularly true when the engine is producing usable thrust during the critical phases of takeoff. Under these conditions it is usually best to delay engine shutdown until the gear is up and speed is V_2 plus 50 KTS.

When Engine Fire/Overheat or Failure procedures are accomplished, use deliberate actions to ensure that the correct controls are actuated.

As soon as the warning bell sounds and the fire area is determined, the captain or first officer should immediately silence the bell so that commands can be clearly understood in the cockpit. When the first officer actuates the bell reset, he advises the captain "Bell off" to signify intentional silencing of the bell.

1. THROTTLE CLOSE . . . . CLOSE

   Close the throttle to idle and silence the gear horn. Allow engine to decelerate to idle speed. Decreasing the speed of the engine decreases the temperature and pressure of the bleed air and removes one possible cause of the fire warning. This also prevents any further damage to the engine that would occur during too rapid a shutdown.

2. WING ISOLATION SWITCH OFF. . . . . OFF

   Place the wing isolation switch Off to close both engine bleed valves and the isolation valve on the affected side. This eliminates the possibility of high temperature bleed air from the wing manifold being the source of the warning. If warning stops after this action, immediate engine shutdown is not necessary.

   Visually inspect engine for evidence of fire or damage. Slowly reapply power to engine. If no further warning, use engine power as required.

3. YAW DAMPER OFF . . . . OFF

   Disengage the Yaw Damper/Autopilot until any necessary trimming of the aircraft has been accomplished. The Yaw Damper/Autopilot may be re-engaged after the aircraft is in trim.

4. WHEN ENGINE AT IDLE AND WARNING PERSISTS START LEVER OFF. . . . . OFF

   Place the start lever Off to stop fuel flow into the engine. This may eliminate the source of the fire or overheat.

5. AT MINIMUM RPM & WARNING PERSISTS, FIRE CONTROL PULL . . . . PULL

   Engineer should monitor the Emergency Valve Closed light. If the light does not come on, place Line Valve Switch to closed position.

   When the Fire Control Handle is pulled the following is accomplished.

   a. The emergency fuel shutoff valve is closed.

   b. Access to the fire extinguisher discharge switch is provided.

   c. The engine bleed valve is signaled to close.

   d. The hydraulic pump supply shutoff valve is closed and the low pressure warning light is deactivated. See chapter 06.01 for hydraulic pump operation with supply shutoff valve closed.

6. FIRE EXTINGUISHER DISCHARGE . . . . DISCHARGE

   Hold the extinguisher discharge switch to the main position for at least three seconds. The AGENT OUT light for the selected bottle should come on. If AGENT OUT light fails to com on, check the circuit breaker on C.B. panel A and use the reserve bottle if circuit breaker is in.

   Visually inspect the engine for fire.

7. IF VISIBLE FIRE EXISTS, DISCHARGE SECOND CHARGE IMMEDIATELY.

   Hold extinguisher discharge switch to the reserve position for at least three seconds.

IGINE FIRE/OVERHEAT (Cont'd)

3. IF WARNING PERSISTS AFTER 30 SECONDS, DISCHARGE SECOND EXTINGUISHER.

If warning light stays on for 30 seconds or goes out and comes back on, discharge second extinguisher.

9. IF WARNING PERSISTS, ACCELERATE TO V_{mo}.

If warning persists after both extinguishers have been discharged, the fire may be extinguished or confined by accelerating to V_{mo} or the highest practical speed for existing flight conditions.

0. IF WARNING PERSISTS, PROCEED TO NEAREST SUITABLE AIRPORT.

1. ANTI-ICE CHECK . . . . CHECK

Turn off engine anti-ice on the inoperative engine. Observe the bleed air limits in chapter 01.05 of this handbook.

2. WING ISOLATION CHECK . . . . CHECK

If warning stopped when the isolation switch was placed Off, leave the switch off to prevent the possibility of the warning reoccuring.

If the warning did not stop when the isolation switch was placed Off, and the bleed air is needed for anti-icing or pressurization, return the isolation switch to Auto. This allows the remaining engine on that wing to supply the bleed manifold.

3. ELECTRICAL POWER CHECK . . . . CHECK

Check for excessive generator loads and make load reduction as necessary.

4. HYDRAULIC POWER CHECK . . . . CHECK

Check that both hydraulic systems are pressurized.

OUBLE ENGINE FAILURE

ouble engine failures in flight require these additional system onsiderations:

a. A failure of any two engines reduces available electrical power 50%. During certain conditions the remaining electrical power is not sufficient to operate all electrical systems simultaneously. Monitor power consumption to avoid overloading the remaining two generators.

b. The loss of both hydraulic pumps in one system can compound the double engine failure with regard to gear retraction and fuel dumping. Some help can be gained by using the auxiliary hydraulic pump provided no fluid loss has occurred.

c. Reduce the bleed air system demands to a minimum to maintain the EGT on the operating engines as low as possible.

ENGINE FLIGHT START

The following procedure for starting an engine in flight shall be used whenever an engine has been deliberately shutdown and a condition exists which necessitates the use of the engine. An IAS of 250 KTS or more will ensure enough windmill RPM to effect an engine start provided no mechanical damage has occurred.

1. START LEVER OFF . . . . OFF

This shuts off fuel flow to the engine and allows airflow to purge it of unburned fuel.

2. THROTTLE CLOSE . . . . CLOSE

Keep throttle closed to limit engine RPM to idle after light-off.

3. WINDMILLING RPM CHECK. . . . . CHECK

Whenever possible, at least 15% RPM should be obtained prior to attempting a start.

4. FIRE CONTROL IN . . . . IN

This opens the fuel supply valve so fuel is available to the engine. Check the Emergency Valve Closed Light for indication of fuel valve opening when the Fire Control is pushed in.

5. LINE VALVE OPEN . . . . .OPEN

If the line valve has been closed, return the switch to OPEN and check the Valve In Transit Light for indications of valve movement.

6. BOOST PUMPS ON . . . . ON

Turn on at least one Boost Pump in the tank supplying the engine or open the crossfeed valve and manifold the engine with another tank.

7. START SWITCH FLIGHT. . . . . FLIGHT

Ensure the ignition selector switch is in both so that both ignition units are armed to fire when the Start Lever is placed to RUN.

8. START LEVER RUN . . . . RUN

Move the Start Lever smoothly to the RUN detent. This starts fuel flow into the engine and energizes the ignition systems. EGT should rise within a few seconds indicating light-off. If EGT does not rise within 20 seconds, place the Start Lever OFF and check ignition circuit breakers. Do not exceed Type I EGT limits.

9. ENGINE AT IDLE, START SWITCH OFF. . . . . . . .OFF

ENGINE FLIGHT START

10. ELECTRICAL POWER CHECK. . . . . CHECK

Check generator ammeters for approximately equal load division.

A.C. POWER LOSS

The loss of all AC power results in the loss of all DC power if the battery switch is in the normal position. The following procedure provides battery power to some circuits and makes it possible to restore power to the AC busses if a generator can be turned on.

1. BATTERY SWITCH EMERGENCY. . . . . .EMERGENCY

This restores power to the Emergency DC bus and provides pressurization from the left turbocompressor if it was previously turned on. The right Alternate Pressure Source is also available, however, its use may create smoke unless the temperature control was positioned to cold prior to the power → failure. The cockpit dome lights can now be used for instrument panel illumination.

2. CROSSFEED VALVES CLOSE. . . . . CLOSE

The crossfeed valves should be closed because all boost pumps are inoperative until power can be restored to the AC load busses. Should an engine flame out due to fuel starvation, having the crossfeed valves closed prevents another engine from drawing air from the same source.

Descend to 26, 000 feet or below as soon as practical because high thrust may not be available without boost pumps operating above 26, 000 feet. If an engine does flame out, use the Emergency Ignition Inverter and Engine Flight Start procedures.

3. EQUIPMENT COOLING FAN ON. . . . . FAN ON

This closes the equipment cooling valve and conserves available air for pressurization.

4. GENERATOR LINE RELAYS OPEN . . . . .OPEN

This makes it possible to restore a generator for Pilot's Essential without powering all load busses and overloading the generator.

5. ANY POSSIBLE FIELD RELAY CLOSE. . . . . . . .CLOSE

Attempt to close at least one generator field relay to provide an operating generator for Pilot's Essential.

6. PILOT ESS BUS ON OPERATING GENERATOR. .CHECK

This restores power to the Pilot's Essential bus and provides an additional source of Emergency DC from #4 T-R.

7. IF CABIN ALTITUDE INCREASING:

a. BATTERY SWITCH NORMAL . . . . NORMAL

This restores power to the Essential DC bus which provides bleed air from both wings and control of all pressure sources.

b. PRESSURIZATION CHECK . . . . CHECK

If cabin altitude is steady, no action is necessary. If cabin altitude is climbing, turn on an additional air source.

8. FREON PACKS OFF. . . . . OFF

Turning off the freon packs prevents overloading a single generator when bus power is restored.

9. RECIRC FAN OFF. OFF

This aids in keeping load to a minimum on a single generator when bus power is restored.

10. ALL BUS TIE SWITCHES OPEN. . . . . .OPEN

This prevents recurrence of multiple bus loss by isolating each AC bus. This also prevents a sync bus fault from affecting any load bus.

11. ALL POSSIBLE FIELD & LINE RELAYS CLOSE. .CLOSE

Attempt to power each load bus by closing its field and line relay.

12. CLOSE BUS TIE RELAYS ONLY TO POWER REQUIRED BUSSES

If all field and line relays can be closed do not close any bus tie relays. If a field and line relay cannot be closed and that bus is required, restore power to that bus by utilizing the sync bus and the appropriate bus tie relays.

ELECTRICAL FIRE

This procedure assumes that an electrical fire is suspected but without an indication of which bus or unit is faulty. Check generator meters and DC ammeter to determine whether the problem is a basic AC or DC bus fault. Unless there is reliable evidence to indicate which area is causing the smoke or fire, the check list procedure is to be followed until the problem is found or isolated.

1. PROTECTIVE OXYGEN & INTERPHONE ON. . . . . ON

Don the supplemental oxygen mask and smoke goggles. Make sure goggle air tubes extend inside the mask. Position microphone and audio selectors to INTERPHONE.

Captain and first officer should turn cockpit speaker audio switches on or put on headsets. Engineer and ACM should put on headsets. Check interphone contact with other crew members.

2. OXYGEN REGULATORS, ALL LEVERS UP. . . . . . UP

This supplies 100% oxygen under pressure to the mask and ensures goggles remain free from smoke contamination.

3. PILOT ESS BUS ON OPERATING GENERATOR . . CHECK

The Pilot's Essential bus is selected to an operating generator because all line relays must be opened which interrupts power to the sync bus. It's preferable to select other than #3 to prevent the possibility of a single generator failure resulting in the loss of all flight instruments.

4. CROSSFEED VALVES CLOSE . . . . CLOSE

All boost and transfer pumps become inoperative when the line relays are opened. If an engine flames out due to fuel starvation, closing the crossfeed valves prevents another engine from drawing air from the same source.

Descend to 26, 000 feet or below as soon as practical because high thrust may not be available without boost pumps operating above 26, 000 feet.

5. RECIRC FAN OFF. OFF

The recirc fan is turned off to prevent any smoke from being recirculated.

ELECTRICAL FIRE

6. GENERATOR LINE RELAYS OPEN. . . . . OPEN

This interrupts all AC power except Pilot's Essential. All bus tie relays will open due to the loss of AC power on the sync bus. Pilot's Essential maintains all the captain's flight instruments and essential radios except his RMI and autopilot. The first officer's altimeter will read uncorrected and all of his flight instruments are inoperative except his HDI and RMI.

Engine instruments still operable are RPM, EGT and Fuel Flow.

7. AC POWER SWITCH STANDBY . . . . STANDBY

This ensures that the manually transferred instruments remain operative in case Essential DC power is restored with #3 bus de-activated.

8. BATTERY SWITCH EMERGENCY. . . . . . . EMERGENCY

This interrupts power to the Essential DC bus and powers the Emergency DC bus by the battery and #4 TR.

Hand rotation of the normal stabilizer trim wheel is necessary.

9. IF PILOT ESS POWER ABNORMAL:

a. FREON PACKS OFF. . . . . OFF
Turn off the freon packs to prevent overloading a generator when the load busses are restored.

b. BATTERY SWITCH NORMAL. . . . . NORMAL

This restores power to the Essential DC bus and provides control of the #2 radios when #3 bus is powered.

c. ALL BUS TIE SWITCHES OPEN. . . . . OPEN
Opening the bus tie relays will prevent overloading the #3 generator when the #3 bus is powered.

d. #3 BUS POWERED. . . . . POWERED
Power the #3 bus by closing the #3 line relay. This restores power to the #2 radios and all the first officers flight instruments except his RMI card and #1 needle.

If #3 generator is inoperative #3 bus must be powered by another generator through the appropriate bus tie relays.

e. COMPASS & DEVIATION SELECTORS #2 . . . . #2
The compass and deviation selectors are placed to #2 position prior to deactivating Pilot's Essential to ensure operation of the captain's flight instruments.

f. AC POWER SWITCH MAIN. . . . . MAIN
Place the AC power switch to MAIN. This will prevent the loss of manually transferred instruments when the Pilot's Essential bus is deactivated.

g. PILOT ESS BUS ON EXTERNAL POWER. . . . EXT PWR
Selecting EXT PWR deactivates the Pilot's Essential bus because all bus tie relays are open.

The Pilot's Essential bus must be selected to #3 position if #3 generator is inoperative and #3 bus is being powered through the bus ties.

10. IF PILOT ESS POWER NORMAL, OPEN EMER DC AND PILOT ESS CIRCUIT BREAKERS NOT REQUIRED.

Open all circuit breakers labeled PILOT ESS and EMER on the circuit breaker panels not required for safe flight.

11. IF CONDITION PERSISTS, OPEN FIELD RELAYS NOT REQUIRED.

Open the field relays not required to further reduce power that could be a possible cause of fire.

12. REVIEW EFFECT OF INOPERATIVE CIRCUITS.

AIR CONDITIONING SMOKE

During normal operations the most probable source of smoke from the air-conditioning system is the turbocompressors. By using the Alternate Pressure sources the turbocompressors can be stopped.

1. PROTECTIVE OXYGEN & INTERPHONE ON. . . . . . . ON

Don the supplemental oxygen mask and smoke goggles. Make sure goggle air tubes extend inside the mask. Position microphone and audio selectors to INTERPHONE.

2. OXYGEN REGULATORS, ALL LEVERS UP. . . . . UP

This supplies 100% oxygen under pressure to the mask and ensures goggles remain free from smoke contamination.

3. RECIRC FAN OFF. . . . . OFF

This prevents the recirc fan from recirculating the smoke.

4. BOTH DC BUSSES (ESS & EMER) POWERED. . . . . PWRD

The essential and emergency DC busses must be powered to have complete control of cabin air sources.

5. ALTERNATE PRESSURE SOURCES OPEN. . . . . . . OPEN

When an alternate pressure source is opened, a temporary overheating odor is normal and should last only a few minutes.

As soon as practical place the temperature selector switches to Manual and toggle manual cold for 20 sec. This prevents the alternate pressure sources from generating smoke because of erratic automatic temperature control systems.

6. TURBOCOMPRESSORS OFF. . . . . OFF

SMOKE REMOVAL

This procedure removes existing smoke and brings in fresh air at the maximum rate provided the source of smoke has been eliminated.

1. RECIRC FAN OFF . . . . OFF
This prevents the recirc fan from recirculating the smoke.

2. TURBOCOMPRESSORS ON . . . . ON

Normally both turbocompressors are on but this is a reminder to have them both on unless they have been the source of smoke.

3. ALTERNATE PRESSURE SOURCES OPEN. . . . . . . OPEN

Open both alternate pressure sources to increase cabin and cockpit airflow.

When an alternate pressure source is opened, a temporary overheating odor is normal and should last only a few minutes.

SMOKE REMOVAL

As soon as practical place the temperature selector switches to Manual and toggle manual cold for 20 sec. This prevents the alternate pressure sources from generating smoke because of erratic automatic temperature control systems.

4. SELECT 10, 000 FT. CABIN ALTITUDE . . . . CHECK

This increases cabin altitude and reduces cabin differential by exhausting air faster than it enters until cabin altitude reaches 10, 000 feet.

Use the automatic pressure control so cabin rate of climb and altitude can be controlled.

5. RATE CONTROL FULL INCREASE. . . . . FULL INC

This helps to accelerate the flow of contaminated air overboard.

6. COCKPIT AIR SHUTOFFS OPEN . . . . OPEN

Open the side air valves and gasper outlets. This increases the airflow into the cockpit and reduces the tendency of air to enter the cockpit from the cabin.

When the cockpit is clear of smoke select the desired cabin altitude and rate of change.

7. IF PRESSURIZING AIR SOURCE NOT AVAIABLE:

a. RAM AIR SOURCE OPEN. . . . . OPEN

The ram air valves open and supply fresh air when ram air pressure is higher than duct pressure.

b. PRESS REGULATORS MANUALLY OPEN . . . . . OPEN

Open both pressure regulators to provide maximum air exhaust and draw the contaminated air below the floor.

CABIN PRESSURE LOSS

This procedure should be used when a rapid increase in cabin altitude is experienced for no apparent reason. A rapid loss of cabin pressure accompanied by fogging within the cabin and cockpit is usually uncontrollable and necessitates descending to 14, 000 feet or below.

The high altitude warning light and intermittent warning horn will come on if the cabin altitude exceeds 10, 000 feet. Anytime an intermittent warning horn sounds in flight the engineer shall check cabin altitude. If the horn is caused by a loss of cabin pressure, he shall silence the horn and advise the captain "Cabin Altitude - Horn Off".

1. OXYGEN MASK & INTERPHONE ON . . . . ON

Don the supplemental oxygen mask and position the microphone and audio selectors to INTERPHONE.

2. WHEN AIRCRAFT ABOVE 14, 000 FEET, INITIATE RAPID DESCENT IF PRACTICAL.

Evaluate aircraft condition to determine the type of descent to be used. If structural damage is suspected, avoid high IAS and abrupt maneuvering.

3. AIR SOURCES CHECK . . . . CHECK

When attempting to control a cabin pressure loss turn on all available air sources, if necessary.

Anytime the Alternate pressure sources are used place the temperature selector switches to Manual and toggle cold for 20 seconds. This prevents the generation of smoke in the cabin.

4. PRESSURE REGULATORS CLOSE . . . . .CLOSE

If either pressure regulator Closed light is out, hold that override switch to CLOSE until cabin pressure loss is stopped or Closed light is On. Leave override switch in the Off position to prevent recurrence of the problem.

5. EQUIPMENT COOLING FAN ON. . . . . FAN ON

This closes the equipment cooling valve to prevent the loss of pressurization air overboard.

6. RECIRC FAN OFF . . . . OFF

This closes the recirc valve and isolates that portion of ducting.

7. FREON SELECTOR BOTH ON . . . . ON

This isolates the packs so that duct leakage in one pack does not affect the other pack.

8. IF CABIN ALTITUDE ABOVE 30, 000 FEET, OXYGEN REGULATORS, ALL LEVERS UP

If cabin altitude is above 30, 000 feet, place emergency lever on oxygen regulator to Emergency position. This ensures pressure flow to the mask.

9. PASSENGER OXYGEN CHECK . . . . CHECK

The Engineer shall open the cockpit door and visually check that the passenger masks have dropped. If the masks have not dropped, place both passenger oxygen override levers up. This causes the passenger masks to drop and provide oxygen to the masks, regardless of cabin altitude.

When the Captain deems it necessary the cabin attendants may be informed of the situation via the PA system. He should also remind them to use the portable oxygen bottle while checking the condition of the passengers. When oxygen is no longer required, an announcement should be made by the Captain.

RAPID DESCENT

This type of descent is generally required if an uncontrollable loss of cabin pressure occurs at high altitude. Prior to accomplishing this procedure evaluate the condition of the aircraft as this procedure assumes the aircraft is structurally sound.

1. THROTTLES CLOSE. . . . . CLOSE

Captain will close the throttles and command the crew to go on oxygen and interphone. Silence the gear warning horn to remove its distracting influence so commands can be heard in the cockpit.

2. WHEN STRUCTURAL DAMAGE SUSPECTED, AVOID HIGH IAS & ABRUPT MANEUVERING

If structural damage is suspected because of extremely high decompression rate, vibration, buffeting or abnormal control position, limit speed as much as possible and avoid high maneuvering loads.

RAPID DESCENT

3 SPOILER SPEED BRAKE UP . . . . UP

Place spoiler speed brake handle full aft. Extending the spoilers causes a significant pitch up trim change which should be anticipated. Be alert for any abnormal roll or pitch caused by asymmetric spoiler extension.

4. AUTOPILOT OFF . . . . OFF

5. LANDING GEAR DRAG BRAKE (375 KTS MAX IAS) DOWN . . . . DOWN

Be alert for the pitch up that occurs when the landing gear extends.

6. DESCENT TARGETS:

a. BODY ANGLE MAXIMUM 15° DOWN

Roll the aircraft smoothly into approximately a 30° bank and nose the aircraft down. Use 15° nose down angle as a target. Avoid using large amounts of nose down trim. When airspeed is definitely increasing roll out of the bank and maintain a pitch attitude which will result in 355 Kts.

b. 355 KTS IAS (375 KTS MAX IAS)

The limiting IAS is 375 KTS with the target speed being 355 KTS. To prevent overshooting the descent airspeed or creating excessive negative "G" forces, avoid changing the aircraft attitude abruptly.

The first officer shall call out each 5, 000' altitude change during the descent. For example, if the descent started at 31, 000', call out 25, 000', 20, 000', etc.

Start smooth rotation of aircraft to decrease rate of descent approximately 2, 000 feet above desired level off altitude. At approximately 500 feet above level off altitude, slowly retract spoilers while continuing to rotate aircraft to a level attitude.

The landing gear drag brake handle must be in NORMAL if the main gear is to be retracted after reaching the desired altitude.

RUNAWAY STABILIZER

During normal trim operation, if the Emergency trim wheels rotate in a direction opposite to the normal trim wheels, it is not a runaway stabilizer. This is caused by slippage of the no-back clutch in the stabilizer actuator, and results in little or no stabilizer movement. When this occurs the stabilizer can be positioned by using the standby trim system.

NORMAL SYSTEM

A runaway of the normal trim system is recognized by continued movement of the normal trim wheels after the aileron wheel thumb switches are released.

1. STOP NORMAL TRIM WHEEL BY HAND

The normal electric trim motor may be stopped by grabbing either normal trim wheel.

2. STAB TRIM HYD SHUTOFF SWITCH CLOSE . . . . CLOSE

This will shutoff hydraulic pressure to the trim motor and stop stabilizer movement. This action renders the speed stability system inoperative.

3. STAB TRIM CONT CIRCUIT BREAKER B9 PULL. . . PULL

This prevents the normal electric trim motor from being damaged by removing power to the motor.

4. EMER STAB TRIM CONT CIRCUIT BREAKER B9 IN. . . IN

This ensures that power is available to the stabilizer trim hydraulic shutoff valve and standby electric trim control system.

5. USE STANDBY TRIM SYSTEM

The preceding steps have prepared the standby system for use. If electric control of the standby system is inoperative, the emergency trim wheels in the sides of the pedestal can be used.

STANDBY SYSTEM

A runaway of the standby trim system is recognized by continued movement of the emergency trim wheels after the standby electric control switch is released.

1. DO NOT ATTEMPT TO STOP EMER TRIM WHEEL BY HAND

2. STAB TRIM HYD SHUTOFF SWITCH OPEN . . . . OPEN

This is the quickest means of removing electrical control power from the standby electric trim system.

3. #1 & #2 HYDRAULIC PUMPS OFF. . . . . OFF

The #1 hydraulic system is depressurized to prevent recurrence of a previous malfunction or runaway of the normal trim system. This also ensures proper response from emergency trim wheel operation.

4. USE EMERGENCY TRIM WHEEL FOR TRIM

If the aircraft is kept in trim, trim forces are minimum. An extreme out of trim condition may require both pilots to simultaneously operate the emergency trim wheels. If excessive trim forces are required, release pressure on the control column momentarily while the trim wheel is being actuated. Increasing or decreasing the airspeed as appropriate until the aircraft is nearly in trim also permits emergency trim to be made with less effort.

ANTICIPATED CRASH LANDING/DITCHING

This procedure provides an orderly manner of preparing for emergency flight termination in minimum time.

If time permits, as much as possible of the normal landing check lists, Preliminary and Final, should be accomplished, except as modified by the following procedure.

1. WHEN TIME PERMITS, REVIEW AMPLIFIED PROCEDURES CHAPTER 03, FLIGHT HANDBOOK.

Review crew duties and aircraft evacuation procedures, described in detail, in Section 03. 21 this Handbook. If gear extension is a problem, review the procedure for landing with partial gear extended in Section 03. 12 this Handbook.

ANTICIPATED CRASH LANDING/DITCHING

2. BATTERY SWITCH EMERGENCY . . . . . . EMERGENCY

This provides power for the fire extinguisher controls, P. A. and other systems on the Emergency DC bus when generator power is no longer available.

3. SHOULDER & SEAT BELTS SECURE . . . . . . SECURE

Check adjustment of seat belt and shoulder harness. If the engineer is unable to be seated in the cabin, he should position his seat to face forward for maximum structural strength.

4. LANDING GEAR:

a. LANDING - GEAR DOWN . . . . DOWN

b. DITCHING - GEAR UP . . . . UP

This allows the smoothest possible contact to be made with the water and sustain minimum aircraft damage.

Pull Warn Horn Circuit Breaker C8
This prevents the warning horn from sounding when the throttles are retarded.

5. WING FLAPS 50° . . . . 50°

This permits the slowest possible approach speed and allows the flap structure to absorb part of the initial impact.

6. EMERGENCY EXIT LIGHTS ON. . . . . ON

This ensures light is available for evacuation and allows the passengers to see the location of emergency exits before touchdown.

Turn the light on just prior to touchdown to prevent the cockpit lights from blinding the pilot.

7. WHEN READY TO SECURE ENGINES, START LEVERS OFF. . . . . OFF

When the captain commands "CUT," the first officer should place all Start Levers to CUTOFF to terminate combustion in the engine.

8. WHEN AIRCRAFT STOPS, PLACE SPOILER SPEED BRAKE HANDLE DOWN, PULL FIRE CONTROLS, AND DISCHARGE MAIN EXTINGUISHERS.

Placing the spoiler speed brake handle in the down detent will minimize the possibility of spoilers obstructing the overwing exit walkways. Pulling the fire controls closes the emergency fuel shutoff valves and provides access to the fire extinguisher discharge switches. Discharging the extinguishers helps retard or suppress an engine fire.

FUEL DUMPING

Notify ATC as soon as possible when fuel dumping is started and again when dumping is completed.

Fuel dumping may be accomplished at any airspeed, in any gear and flap configuration or at any altitude. When the emergency permits, do not dump at an altitude of less than 2, 000 feet above the terrain to reduce the possibility of ground ignition of fumes.

The Vapor Zone around an aircraft dumping fuel is that airspace 1, 000 feet above, 2, 000 feet below, 5 miles aft and 1/2 mile abeam. Atmospheric conditions may cause a combustible concentration to remain in the area for a period of time, therefore, do not circle when dumping fuel.

Dumping fuel while fire exists on the aircraft can only increase the hazard. If dumping is desired after a fire, be certain the fire has been completely extinguished.

Manage the fuel dumping sequence so that the Fuel Distribution Limitations as outlined in Chapter 02. 12 are complied with prior to landing.

1. JETTISON SWITCHES (3220 LB/MIN TOTAL) OPEN. . .OPEN

This activates the four jettison pumps from #1 hydraulic system and pumps fuel overboard at the approximate rate of 805 lbs/ min/ tank.

Turning on the scavenge pumps at this time does not increase the total dump rate because of the capacity of the jettison line.

2. REPLENISH PUMPS ON . . . . ON

This is to expedite the emptying of the inboard replenish tanks.

3. IF #2 & #3 TANK SCAVENGE DESIRED:

When a crash landing or ditching is anticipated, it is desirable to empty the inboard tanks by use of the scavenge pumps.

The scavenge pumps can also be used to jettison fuel from the inboard tanks if #1 hydraulic system is inoperative.

a. CROSSFEED VALVES OPEN . . . . OPEN

Open the engine crossfeed valves and allow the outboard fuel to supply the operating engines. Do not open the emergency crossfeed valves so the fuselage area remains isolated from the crossfeed system.

b. #1 & #4 BOOST & TRANSFER PUMPS ON . . . . . ON

This ensures that all engines continue to receive an adequate fuel supply when the inboard tanks are empty.

c. SCAVENGE SWITCHES (1610 LB/MIN TOTAL) OPEN. OPEN

This activates the two scavenge pumps from #2 hydraulic system.

d. #2 & #3 MAIN TRANSFER PUMPS ON . . . . ON

This ensures a maximum supply of fuel is available to the scavenge pumps.

If #1 hydraulic system is inoperative and scavenge pumps are being used to jettison fuel, use the main transfer pumps only. This allows fuel in the inboard replenish tanks to partially compensate for outboard fuel weight as long as there is any fuel in the inboard tanks.

FUEL DUMPING

4. MONITOR HYD SYSTEMS & FUEL QUANTITY

The Engineer should monitor hydraulic quantity for any abnormal change as each jettison or scavenge pump is turned on.

Use the fuel quantity gauges to ascertain that dumping has started and to determine when the desired amount of fuel is dumped.

5. WHEN DUMPING COMPLETE, JETTISON & SCAVENGE SWITCHES CLOSE . . . . CLOSE

Place the switches to Close and visually check the jettison nozzles to ensure that all valves are closed. If jettison flow continues and it is necessary that flow be stopped, shut down #1 hydraulic system. Use Manual Extension Procedure for the nose gear when the gear is lowered for landing. Use rudder/brakes for directional control after landing.

6. STANDPIPE FUEL REMAINING:

Jettison Only	11, 390 lbs
Jettison & Scavenge Dry	6, 030 lbs

BRAKE FIRE/SMOKE

This procedure assumes the tower or another aircraft reports the aircraft wheel(s) are smoking or on fire. To confirm whether it is normal brake smoking or an actual fire, proceed as follows:

1. STOP AIRCRAFT

2. ALERT EMERGENCY EQUIPMENT

Request the control tower operator to have the emergency equipment standby.

3. CONFIRM NATURE OF REPORTED BRAKE PROBLEM

Verify condition of brakes by directing a Crew Member to check from the forward cabin or galley doors, by lying on floor and looking under the wings. If unable to adequately verify condition, proceed to aft cabin or galley doors and check from there. Advise Captain whether smoke, obvious overheat or visible fire exists.

4. IF FIRE VISIBLE:

a. PARK BRAKES

Park the brakes to prevent the aircraft from moving during evacuation.

b. SHUT DOWN ENGINES

c. EVALUATE NEED TO EVACUATE

If emergency equipment is on the scene and has the fire under control, consider remaining on board until steps are brought to the aircraft. If emergency equipment is not immediately available and fire persists, evacuate via the most practical means available (jetway, boarding steps, evacuation slides). Use the PA and/or voice commands to keep the evacuation calm and orderly.

5. IF EXCESSIVE SMOKE APPARENT

a. TURN NOSE WHEEL FULL TRAVEL TO PREVENT ROLLI

If the aircraft continues to move with all engines at idle thrust, turning the nose wheel full travel in either direction may be effective in maintaining position.

b. LEAVE BRAKES OFF

If the brakes are overheated with no visible fire, the brakes should be released and the Pilot standby at the controls until the wheels are chocked.

c. MONITOR GEAR FOR INDICATION OF FIRE

CAUTION

When inspecting overheated tires and wheels approach them from the front or rear only.

For extinguishing brake fires use dry chemical, fog or foam type extinguishers.

For cooling overheated brakes use fog or foam type extinguishers but avoid spraying coolant directly on inflated tire and wheel.

* * *

A. SECTION COVERAGE

This section covers two basic areas of Emergency Procedures.

1. Amplifies the Other Emergencies Guide List.

2. Presents other emergency procedures not covered on the Emergency Check List or the Other Emergencies Guide.

→ B. TWO ENGINE INOPERATIVE PROCEDURE

When the loss of two engines results in an asymmetrical thrust condition, be alert on the rudder to maintain directional control. Keep the ball centered and use a minimum of aileron input for directional control. Plan the approach so that large changes in thrust level will not be necessary to maintain the required flight path.

APPROACH

1. CHECK MAX GROSS WEIGHT TABLE IN 03. 12 OF FLIGHT HANDBOOK
Jettison fuel as necessary to reduce gross weight to the values shown. Do not dump below standpipe level (11, 390 lbs. total fuel) regardless of chart value shown.

TEMP °F	ALTITUDE			
	SEA LEVEL	2000 FT	4000 FT	6000 FT
100	155, 000	144, 500	134, 000	124, 000
80	155, 000	153, 000	142, 500	132, 000
60	155, 000	155, 000	148, 000	138, 000
-65	155, 000	155, 000	153, 000	143, 500

2. COMPLETE PRELIMINARY CHECK LIST

*3. REVIEW MISSED APPROACH PROCEDURE
The missed approach procedure is indicated by an asterisk on the check list and follows the basic approach procedure. Amplification of the missed approach procedure follows this amplification.

4. FLAPS 20°

5. MINIMUM SPEED, BUG + 30 KTS BUT NOT LESS THAN 160 KTS
Enter base leg at approximately 1500 feet above the field. Maintain BUG + 30 Kts. but not less than 160 Kts. as a minimum speed for 20° flaps.

6. AUXILIARY HYDRAULIC PUMP ON
Unless a prior malfunction has rendered it inoperative or unuseable, place the auxiliary hydraulic pump On prior to final approach. This provides the maximum fluid volume available should a missed approach be necessary.

7. INTERCEPTING APPROACH SLOT, GEAR DOWN
Establish a normal sink rate as the approach "slot" is intercepted. When sink rate has been established, extend the landing gear. Maintain BUG + 30 Kts. but not less than 160 Kts. Gear and flap configuration will remain the same until reaching commit point.

8. COMPLETE FINAL CHECK LIST

9. TURNING FINAL, REDUCE TO BUG + 30 KTS BUT NOT LESS THAN 160 KTS
Avoid turning at low altitudes by planning the approach pattern so the turn to final is complete at approximately 1000 feet above the field, weather permitting. Make adjustments as early as possible to establish the proper approach path. Avoid high rates of sink close to the ground. Maintain an approach path that will not require large thrust applications.

10. AT COMMIT POINT (APPROX 400 FT), FLAPS 30°
Determine whether the landing can be made or if a go-around is required prior to extending the flaps to 30°. Pull out capability is dependent on speed and drag configuration, both of which must be altered at the commit point if the landing is to be made. If the decision is to go-around, execute the Missed Approach procedure.

11. START SPEED BLEED
When committed to land, start speed bleed toward BUG + 10 Kts.

12. UPON REACHING POSITION WHERE FIELD CAN BE MADE WITH IDLE THRUST:
When the pilot feels he can reach his intended landing point with both engines at idle thrust the following steps should be accomplished.

a. FLAPS 50°

b. BLEED SPEED TOWARD BUG + 5 KTS
Careful speed control is of utmost importance. Too high a threshold speed can result in an overshoot. Too slow a speed can result in an undershoot or loss of directional control if high asymmetrical thrust is applied to correct speed.

*MISSED APPROACH

1. APPLY TAKEOFF THRUST, CHECK DESCENT & KEEP BALL NEARLY CENTERED
Apply takeoff thrust to the two operative engines and rotate the aircraft sufficiently to check the rate of descent. Coordinate rudder input as thrust is applied to prevent a severe yaw tendency. Keep the ball as nearly centered as possible. It may be necessary to bank into the power as much as 5° to maintain heading with high asymmetric thrust settings.

2. AT A MINIMUM OF BUG + 30 KTS & ACCELERATING, RETRACK FLAPS & GEAR
If speed has gone below Bug + 30 Kts. it may be necessary to accept a slight loss of altitude to regain speed. With minimum of Bug + 30 Kts. and speed increasing, retract gear and flaps.

3. ACCELERATE TO BUG + 50 KTS & CLIMB TO MEA
Altitude may be maintained or a slight loss accepted, while accelerating to best angle of climb speed of Bug + 50 Kts. Maintain speed at Bug + 50 Kts. and climb until minimum enroute altitude is reached.

4. PERFORMANCE PERMITTING, USE CLIMB THRUST
Dependent on aircraft performance it is desirable to reduce thrust to climb settings. Gradual thrust reduction should be attempted while maintaining climb at Bug + 50 Kts. When reaching minimum enroute altitude accelerate to two engine enroute climb speed. See Chapter 1, this Handbook.

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ALL ENGINE OR ONE ENGINE INOPERATIVE MISSED APPROACH PROCEDURES

To make more thrust available during a missed approach, consideration should be given to turning OFF the turbo-compressors and wing anti-icing.

1. Apply takeoff thrust and rotate to climb attitude.
2. Retract flaps to 30°.
3. With positive rate of climb, retract landing gear.
4. Maintain V_{ref} to V_{ref} + 5 KTS to 800 ft. above airport elevation (Max. bank angle 15°). If V_{ref} below 145 KTS, slowly accelerate to 145 KTS.
5. At minimum of 800 ft. above airport elevation, accelerating and V_{ref} + 10 KTS, flaps to 20°.
6. At V_{ref} + 30 KTS, retract flaps to 0°.

REJECTED TAKEOFF PROCEDURE

The decision to reject a takeoff is the sole responsibility of the captain. If a takeoff is rejected regardless of who is making the takeoff, the captain will execute the reject using the following procedures:

1. Apply full brakes while closing the throttles.

CAUTION
With main wheel anti-skid inoperative, apply brakes in a gradually increasing manner to prevent skidding.

2. Extend spoilers and apply reverse thrust.
   a. Captain will immediately actuate the spoiler handle.
   b. Use reverse thrust as outlined in section 02.40 this handbook.
3. Consult the Rejection Takeoff (RTO) chart (Brake Cooling Schedule), section 03.13 this handbook to determine what waiting period or brake inspections must be made before starting the next takeoff.
4. With aircraft stopped and before taxiing, return all items listed on the "Before Takeoff" checklist to the positions normally used during taxi.

NO FLAP PROCEDURE

1. COMPLETE PRELIMINARY CHECK LIST
2. SET BUG TO V_{ref} + 25KTS
   When landing is being made with partial or no wing flaps available policy is to increase Bug speed 5 Kts. for each 10° of flaps less than 50°.
3. GEAR DOWN
4. COMPLETE FINAL CHECK LIST
5. MINIMUM MANEUVERING, BUG + 25 KTS
   During maneuvering maintain a speed of Bug + 25 Kts. to provide adequate speed margin above stall.
6. USE NORMAL APPROACH SLOT. REDUCE TO BUG ON FINAL
   Reduce IAS to Bug when established on final. Use a normal approach slot.

F. **WINDOW ARCING/CRACKED/OVERHEAT**

Arcing is identified as a visible glow in one area or across the panel. This will cause local overheating and if uncorrected it may cause the panel to crack.

Overheating is recognized by excessive heat radiation and bubbles forming in the panel if allowed to continue for an extended period of time.

Cracks are easily recognizable and may vary in number from a single line to a complete shattering.

When any of these conditions occur accomplish the following procedure.

1. AFFECTED WINDOW HEAT SWITCH OFF . . . OFF
   This removes electrical power from the affected window or pair of windows in case of the aft or sliding windows.
2. CHECK WINDOW CONDITION:
   To determine the number of layers cracked, hold edge of check list against crack. Shine flashlight from one side of check list and inspect crack from the other side.

   If shattering prevents inspection of layers, assume multiple layers are cracked.

   a. SINGLE LAYER CRACKED, NO PRESSURE REDUCTION
      A single layer crack does not affect the strength of the window, therefore, a pressure reduction is not required.
   b. MULTIPLE LAYERS CRACKED, 5 PSI MAXIMUM
      Reduce cabin pressure at a comfortable rate to 5 PSI. Closely monitor cabin altitude and descend aircraft, if necessary, to keep cabin altitude below 10,000 feet. If necessary, cross check cabin altitude chart Chapter 08.01 this Handbook.
3. AFFECTED WINDOW C.B. (B-5) PULL . . . PULL
   a. Sliding and Aft Windows
      This ensures power is removed from the affected window.
   b. Pilot's Main and Center Windows
      This only removes control power from the affected window. To ensure complete removal of power the current limiters on the load bus must be removed.

      (1) Captain's window - pull both current limiters on No. 2 Bus.
      (2) First Officer's or Center window - pull both current limiters for the respective window on No. 3 Bus.
4. BELOW 10,000 FEET, 300 KTS MAXIMUM
   With electrical power removed from either Pilots' main or center window panel, limit airspeed to maximum of 300 Kts. when operating below 10,000 feet.

G. **JAMMED STABILIZER PROCEDURE**

(ASSUMES NOSE UP TRIM REQUIREMENTS)

If the stabilizer fails to respond to thumb switch operation check the following before assuming the stabilizer is jammed: autopilot disengaged, STAB TRIM CONT circuit breakers set, #1 hydraulic system pressurized, and operation of the normal trim wheels, standby electric trim controls, and emergency trim wheels.

JAMMED STABILIZER PROCEDURE

This procedure assumes nose up trim requirement. If nose down trim is required revise the procedure by moving the spoiler selector switch to nose down to deactivate the outboard spoilers. Maximum IAS in this configuration is restricted to 245 KTS (.60M).

APPROACH

1. SELECT NOSE UP WITH SPOILER SEL SWITCH
This deactivates the inboard spoilers.

2. TRIM WITH SPEED BRAKE HANDLE
Move speed brake handle aft smoothly so that any abnormal roll or pitch can be compensated for immediately. It is not necessary to accomplish hands off trimming of the aircraft at this time, since the aircraft configuration will be changed. Move the speed brake handle aft enough to minimize the elevator load required to keep the desired aircraft attitude. Do not move the spoiler speed brake handle aft of the double line into the restricted area of the quadrant. With the spoilers extended lateral control sensitivity is increased.

3. COMPLETE PRELIMINARY CHECK LIST

4. SET BUG TO V_{ref} + 10 KTS
Bug speed for the entire approach and landing is normal V_{ref} + 10 Kts.

**5. REVIEW MISSED APPROACH PROCEDURE
The captain and first officer should review the missed approach procedure.

It is desirable to have the aircraft in landing configuration approximately 2000 ft. above the terrain in the airport vicinity. This is to permit final trimming of the aircraft and evaluation of flare capability prior to approach.

6. REDUCE SPEED, FLAPS 30°
Extend the flaps to 30° and reduce the IAS to bug + 20 kts. Retrim the aircraft as necessary using the spoiler/ speed brake.

7. GEAR DOWN
Extend the gear and maintain altitude.

8. COMPLETE FINAL CHECK LIST

9. FLAPS 40°
As the flaps are lowered use the spoiler/ speed brake to keep the aircraft in trim.

10. ESTABLISH NORMAL DESCENT RATE AT BUG SPEED
Slow to bug speed and set up the sink rate used for a normal slot to determine flare capability. Maintain bug speed by use of throttles.

11. EVALUATE FLARE CAPABILITY
If an approximately trimmed condition can be achieved in this configuration and at bug speed, a flare check is not necessary as sufficient elevator control is available for flare.

If an approximately trimmed condition cannot be achieved, accomplish a flare check or evaluate additional means available to provide flare capability such as: increasing the bug speed or delaying thrust reduction at landing until flare is completed.

To check the flare capability reduce power by 50% and simultaneously attempt to flare the aircraft, the same as for a normal landing.

12. INCREASE TO BUG + 10 KTS FOR MANEUVERING
Increase IAS to bug + 10 kts. to provide adequate stall protection for maneuvering into position for landing. Plan a normal approach slot.

13. REDUCE TO BUG ON FINAL & MAKE NORMAL APPROACH
When normal approach slot is reached, establish normal sink rate and reduce speed to bug. Maintain bug speed until touchdown.

14. WHEN FLARE IS STARTED, FLAPS 50°
When the flare is started, extend flaps to 50° and complete landing. Since the aircraft decelerates more rapidly with extended speed brakes, thrust should not be completely reduced until over the runway. After the nose wheel is on the runway, place spoiler/speed brake handle full aft. Do not restore deactivated spoilers until landing roll is completed because of the resultant adverse pitch change. Always have speed brake handle in the down detent prior to moving the spoiler selector switch. Use normal reverse and braking technique.

**MISSED APPROACH

1. APPLY TAKEOFF THRUST

2. RETRACT FLAPS TO 30°
Flap retraction and thrust application will require some adjustment in trim. Do not move spoiler selector switch. Adjust pitch trim only with speed brake handle.

3. WITH POSITIVE RATE OF CLIMB, RETRACT GEAR

4. TRIM WITH SPEED BRAKE HANDLE
If further flap retraction is desired, use normal speed schedule for flap retraction. Less trim is required as the aircraft speed increases, adjust trim with speed brake handle.

GEAR LEVER LOCKED

(TRUCK LIGHT OUT)

1. IF GREATER EMERGENCY EXISTS, OVERRIDE LEVER LOCK & RETRACT GEAR
When immediate drag reduction is necessary, disregard any abnormal indications, override the gear lever lock and retract the gear.

2. NOSE STEERING WHEEL NEUTRAL CHECK . . . CHECK
An uncentered nose wheel constitutes a potential gear retraction hazard. Determine that the cockpit steering wheel indicates center. If not centered, move the wheel as necessary to accomplish centering.

3. IF WHEEL DOES NOT REMAIN IN NEUTRAL, DO NOT RETRACT GEAR
If the steering wheel can be moved but returns to an off-center position when released, a steering malfunction is indicated. The gear should not be retracted if this situation occurs.

If the steering wheel remains displaced and cannot be positioned to center, consideration should be given to potential landing problems. Hydraulic pressure to the nose steering system can be removed by either moving the landing gear lever to neutral or placing the No. 1 hydraulic system pump switches to OFF.

4. WITH WHEEL NEUTRAL & LEVER LOCKED
If the gear lever is still locked down when the nose steering wheel is centered and the truck position light is out, the malfunction is probably a faulty nose wheel centering switch, truck position switch, or left gear ground safety switch.

   a. PULL BOTH LDG GEAR GROUND SAFETY SWITCH CB's (C-8) . . . PULL
   Pulling the gear ground safety switch circuit breakers interrupts power to the ground safety relays to provide airborne sensing to the SCAT system and other units controlled by the ground safety relays.

   Pulling these CB's will not return the affected outflow valve to normal operation; however, electrical operation is available.

GEAR LEVER LOCKED

b. OVERRIDE LEVER LOCK & RETRACT GEAR

(1) The gear warning horn will sound when the override release is moved toward the override position if the left gear ground safety switch is in the "ground" position. The horn will stop when the override is returned to its normal position.
(2) If either the gear unsafe light or the door warning light remains on after gear retraction, place the gear lever down and do not recycle the gear.
(3) If the left gear ground safety switch remains in the "ground" position after takeoff the forward outflow valve will be receiving ground sensing and will remain full open. The aft outflow valve will close attempting to pressurize the aircraft, therefore the aft outflow valve closed light will come on.
(4) If these indications are present, toggle the forward pressure regulator switch toward closed until a normal cabin rate of climb is established. While maintaining a comfortable rate of climb continue to toggle toward closed until the forward outflow valve closed light comes on; then toggle switch toward open until the light goes out. Leave the control switch off for the remainder of the flight. If the switch is returned to Auto while the gear ground safety switch is in the "ground" position, the aircraft will depressurize.
(5) JUST AFTER TOUCHDOWN, RESET SAFETY SW CB's (C-8) . . . RESET
Resetting the gear ground safety switch circuit breakers immediately after touchdown will assure proper operation of units which require ground sensing. If the circuit breakers are not reset, all main landing gear brakes will release when the aircraft decelerates to approximately 10 knots and will stay released until the circuit breakers are reset or the anti-skid switch is placed to off.

GEAR TRUCK LIGHT ON

This procedure is to be followed when the landing truck indicator light is still illuminated after takeoff.

1. IF GREATER EMERGENCY EXISTS, OVERRIDE LEVER LOCK & RETRACT GEAR
When immediate drag reduction is necessary disregard any abnormal indications, override the gear lever lock and retract the gear.

2. IF LEVER NOT LOCKED, RETRACT GEAR
Due to the circuitry and mechanical switch linkages involved when a truck light remains on but the gear lever is free to move, the probable cause is malfunction of the indication circuit. Proceed with gear retraction. If the first retraction attempt results in either the gear unsafe or ldg. door light remaining on, place the gear lever down and do not recycle the gear.

3. IF LEVER LOCKED, DO NOT RETRACT GEAR
If the gear lever is locked with the landing truck light On, a definite malfunction of a truck positioner is indicated. Do not retract the gear as damage will likely occur to the gear or wheel well structure.

GEAR UNSAFE LIGHT ON BEFORE GEAR RETRACTION

If the gear unsafe light comes on as the aircraft becomes airborne while the gear lever is still in the down detent, it is usually due to the right gear ground safety switch remaining in the ground position. Proceed as follows:

1. IF GREATER EMERGENCY EXISTS, RETRACT GEAR
When immediate drag reduction is necessary, disregard abnormal indication and retract the gear.

2. PULL BOTH LDG GEAR GRD SAFETY SWITCH CB's (C-8)

a. The gear unsafe light should go out. Pulling the gear ground safety switch circuit breakers interrupts power to the ground safety relays to provide airborne sensing to units controlled by the ground safety relays. Pulling these CB's will not return the affected outflow valve to normal operation; however, electrical operation is available.

b. If the gear unsafe light remains ON, DO NOT RETRACT THE GEAR.

3. WITH GEAR UNSAFE LIGHT OUT, RETRACT GEAR
The gear unsafe light will come on during gear retraction and go out when the gear has retracted.

4. CHECK LDG GEAR DOOR WARNING LIGHT OUT

a. If the door warning light remains on after the gear has had sufficient time to retract, place the gear lever down and do not recycle the gear.

b. If the right gear ground safety switch remains in the ground position after takeoff, the aft outflow valve will be receiving ground sensing and will remain full open. The forward outflow valve will close attempting to pressurize the aircraft, therefore the forward outflow valve closed light will come on.

c. If these indications are present, toggle the aft pressure regulator switch toward closed until a normal cabin rate of climb is established. While maintaining a comfortable rate of climb continue to toggle toward closed until the aft outflow valve closed light comes on; then toggle switch toward open until the light goes out. Leave the control switch off for the remainder of the flight. If the switch is returned to Auto while the gear ground safety switch is in the ground position the aircraft will depressurize.

5. RESET BOTH LDG GEAR GRD SAFETY SWITCH CB's ON TOUCHDOWN
Resetting the ldg gear ground safety switch circuit breakers immediately after touchdown will assure proper operation of units which require ground sensing. If the circuit breakers are not reset all main landing gear brakes will release when the aircraft decelerates to approximately 10 knots and will remain released until the circuit breakers are reset or the anti-skid switch is placed to off.

HYDRAULIC PUMP FAILURE

A hydraulic pump failure is indicated by the pump low pressure light coming On.

1. FAILED PUMP INLET CLOSED . . . INLET CLOSED
Closing the supply shutoff valve prevents any loss of hydraulic fluid, which might subsequently occur at the pump, from affecting the system. The supply shutoff valve for the failed pump should not be opened for the remainder of the flight.

Check the system fluid quantity. If any indication of fluid loss evident, refer to hydraulic fluid loss procedure this section.

When a single pump is supplying No. 2 system pressure, main gear retraction time will be slightly longer.

L. USE OF AUXILIARY HYDRAULIC PUMP IN FLIGHT

During a two engine approach, if fluid loss has not occurred in either system, the auxiliary pump is turned On. If only the auxiliary pump is providing pressure, gear and flap operating times will be significantly longer.

The auxiliary pump may be used in flight when system pressure has been lost but no fluid loss has occurred in either system. Use the pump only when required to operate a unit.

M. HYDRAULIC FLUID LOSS

This procedure is based on the normal inflight isolation of the hydraulic systems by the interconnect shutoff valve. Under normal circumstances, any individual leaking unit or component should result in the cockpit indication of only one quantity gauge dropping. Should both cockpit indicators indicate a loss of fluid simultaneously, accomplish the procedure simultaneously for both systems.

1. AFFECTED SYSTEM PUMPS INLET CLOSED . . . INLET CLOSED
This eliminates all pressure and flow in the system, stopping further loss of the limited volume of fluid available.

2. IF LOSS CONTINUES, BOTH PUMPS OFF . . . OFF
If the loss continues with the supply shutoff valves closed, this indicates a fluid leak that cannot be isolated. Place both pump control switches to the Off position to provide pump cooling and lubrication as long as any fluid remains in the system lines.

3. IF LOSS STOPS, RETURN PUMPS ONE AT A TIME TO OFF & CHECK QUANTITY
If loss of fluid resumes when either pump switch is positioned to Off, return that switch to Inlet Closed.

4. SEE 03.12 FOR SYSTEM RESTORATION PROCEDURES
With the pumps Off and the fluid loss contained, restoration of the system may be possible. Consideration should be given to whether an attempt should be made immediately to restore pressure or delayed until some time just prior to landing. Except for the loss of normal stabilizer positioning associated with No. 1 system, no difficulty should be encountered during cruise flight with either system shut down. When ready to attempt restoration, place one pump switch On and monitor quantity indicator. If fluid loss resumes, return switch to Off. If the first pump placed On does not indicate leakage, do not attempt to restore the other pump in the system.

Loss of No. 1 system will require:

a. Electric standby operation of stabilizer trim system.

b. Operation at speed stability inoperative speeds.

c. Loss of autopilot auto trim system, requiring manual trim of aircraft if autopilot is used.

d. Manual extension of nose gear.

e. Loss of nose wheel brakes.

f. Loss of nose wheel steering.

g. Inability of jettisoning any fuel from outboard tanks; inboards may be dumped by utilizing scavenge pumps.

Loss of No. 2 system will require:

a. Manual extension of main gear.

b. Alternate braking technique.

c. Loss of fuel scavenge capability.

N. EMERGENCY HYDRAULIC FLUID REPLENISHMENT

If hydraulic fluid loss has deactivated one or both hydraulic systems, and reactivation is considered necessary, the #1 hydraulic reservoir may be replenished with water from the aircraft water system. Use the following procedure:

1. Place the hydraulic pump switches for the depleted system to INLET CLOSED.

2. Proceed to 'ydraulic compartment access door, forward of seat 17C, and enter compartment.

3. Remove filler cap from #1 system reservoir and insert hose from water valve on Aft bulkhead.

4. If Fluid is needed in #2 system, open the interconnect valve by operating the guarded switch on the Aft bulkhead.

5. Open water valve and fill reservoir until it overflows.

O. HYDRAULIC FLUID OVERHEAT

When a condition exists that causes excessive hydraulic fluid temperature indication, use of the system is limited to the time necessary to accomplish landing gear retraction and flap retraction. When an overheat occurs during takeoff, the condition should be noted and the following steps accomplished as soon as normal climb configuration is established.

1. AFTER GEAR & FLAPS UP, AFFECTED SYSTEM PUMPS OFF . . . OFF
Place both pump control switches to the OFF position. The system should remain shut down for the duration of the flight unless the need for it is of an emergency nature.

2. RESTORE SYSTEM ON APPROACH
Activate the system on the approach, prior to extending the gear, and leave the pump switches On for the remainder of the approach and landing. As each pump is restored to operation, carefully observe system indications to avoid operating a faulty pump.

P. MANUAL GEAR EXTENSION

When a landing gear fails to properly indicate a green light the following checks should be made:

a. Use the Master Test switch to check the landing gear indicators.

b. Check the LDG POS & WARN circuit breaker on C-8.

If either main gear fails to indicate down and locked after normal extension, check the LDG DOOR light. If the light is not illuminated, determine from a ground observer that the gear is physically extended. If gear is visible, and the LDG DOOR light is out, it can be safely assumed that the gear is locked down since the main doors cannot be physically actuated unless the down lock is engaged.

MANUAL GEAR EXTENSION

A further check of the right main gear down lock can be made by checking the anti-skid release lights. The right down-lock switch controls the illumination of all anti-skid lights.

When forewarning indicates a manual extension of one or all landing gear is necessary, leave gear lever in neutral. This conserves fluid in the main gear accumulator to provide additional main braking capability after landing.

. 170-320 KTS CHECK . . . CHECK
Maintain speed at 170 knots or greater to provide necessary aerodynamic assist in extension of the gear. Do not exceed 320 knots limit for nose gear extension.

2. AFFECTED GEAR EMERGENCY RELEASE LATCHED DOWN . . . LATCHED DOWN
If difficulty is encountered in moving the appropriate lever, it may be necessary to apply a greater force by steadily pressing down on lever with foot. Do not shock load by jumping or stamping on lever. If necessary to extend all gear with the emergency extension system, the suggested procedure is to operate the shorter main lever first for convenience sake. Either may be operated without affecting the other.

3. WHEN AFFECTED GEAR INDICATES DOWN, GEAR LEVER DOWN . . . DOWN
Manual extension should result in a green light indication for the affected gear. Assuming a single gear system manually extended, placing the gear lever down will extend the other gear(s). Even if all gear were manually extended placing the gear lever down prevents the annoyance of the gear warning horn sounding at touchdown. If all gear have green light indication, placing the gear lever down will put the gear unsafe light out.

If the nose gear were extended manually, placing the gear lever down is necessary to provide No. 1 system hydraulic pressure to the nose wheel steering.

4. GEAR INDICATOR LIGHTS CHECK . . . CHECK
All green lights should be on. If the main gear were extended manually the landing door light will remain on due to main doors being open. Sufficient ground clearance exists with the main doors open to prevent damage on landing.

If the nose gear fails to indicate down, after manual extension has been accomplished, it may be locked down by using the emergency downlock rod. This rod is stowed in the electronics compartment. Procedure for use of the rod is as follows:

a. Depressurize the aircraft. It is suggested that one turbocompressor be operated for cabin ventilation and to provide a slight positive pressure in the aircraft.

b. Enter the electrical/ electronics compartment through the hatch in the forward coat compartment floor.

c. Remove the nose gear inspection hole cover on the forward bulkhead of the compartment.

d. Remove downlock rod from the right side electrical rack and insert through inspection hole.

e. Hook rod around attach bolt at top of downlock actuator rod.

f. Grasp rod handle and pull until red line on actuator lines up with red mark on drag strut.

g. Place tip of downlock rod over grease fitting in downlock assist spring cartridge aft end fitting. Push forward to close downlock.

5. BRAKE PRESSURES CHECK . . . CHECK
Check the Brake Pressure Indicator at this time, particularly if No. 2 system was involved in the gear problem. Also check the Emergency Brake Pressure gauge so the crew is aware of all available braking potential prior to landing.

6. If gear not down, see 03.12, Flight Handbook, for supplemental extension system procedures.

Q. SUPPLEMENTAL LANDING GEAR EXTENSION SYSTEM

If manual extension procedure was not successful in lowering the affected gear(s), proceed as follows:

1. Leave emergency extension lever(s) DOWN.

2. Place landing gear lever to NEUTRAL.

3. Maintain 170-320 knots.

4. Place service interphone switch ON.

If the service interphone is inoperative, use one of the cabin attendants to relay gear indication from the cockpit to the crew member operating the supplemental extension system. On those flights without cabin attendants, use the PA system.

5. Proceed to hydraulic compartment access door, forward of seat 17C, with headset, microphone and flashlight.

6. Enter compartment, remove pump cover, locate pump handle in cover and install handle in pump.

7. Close No. 1 hydraulic reservoir fill valve. This valve should be found normally safetied open.

8. Place gear selector to desired position and operate hand pump. When a gear uplock has been unlocked that gear will tend to free fall toward a down position. Hand pump operation will be required to assure that the gear locks down. Normal operation time for extension of a main gear is approximately five minutes; the nose gear should take approximately three minutes. Maintain interphone communication to verify gear position.

9. Gear down is indicated by a reported green light from the cockpit. It is normal for the landing door light to remain ON when a main gear has been pumped down.

10. Return selector to OFF. Leave No. 1 hydraulic reservoir fill valve closed to trap extension pressure in line(s). Stow pump handle and cover. Re-install compartment access door after returning to cabin.

11. Place landing gear lever DOWN upon return to flight deck.

R. LANDING WITH UNSAFE GEAR INDICATION

If safe landing gear indication cannot be obtained after all attempts for landing gear extension have been made, the following steps should be taken in preparation for the landing.

1. Jettison fuel to minimum level. Inboard tanks may be scavenged SCD provided No. 2 hydraulic system pressure available.

2. If emergency gear extension has been attempted, and it is desired to keep hydraulic pressure on the gear during landing, the emergency extension lever(s) must be returned to the normal detent.

LANDING WITH UNSAFE GEAR INDICATION

3. Advise the Ground Crew by radio of all existing gear and door light indications.

After landing, use reverse thrust and moderate braking to stop aircraft. When aircraft comes to a stop, keep all engines at idle, hydraulic pumps on, gear handle down and brakes on. Do not turn off runway until Ground Crew has visually inspected gear and installed gear pins or secured gear by other means.

LANDING WITH AVAILABLE GEAR

If all landing gear cannot be extended, some conditions such as landing on a runway or smooth terrain may provide best directional control and minimum structural damage if the landing is made with all gear retracted. The inboard pods and pylons are designed to support the aircraft during a controlled landing on a hard-surfaced runway.

Accomplish the anticipated crash landing preparation and use normal landing flaps to provide minimum speed and maximum aileron control.

If conditions dictate that a landing be made with partial gear extended, use the following procedures.

1. RECOMMENDED ACTION BEFORE AND DURING LANDINGS WITH LESS THAN NORMAL LANDING GEAR AVAILABLE.

   a. Review and execute, as applicable, ANTICIPATED CRASH LANDING procedures, as outlined in 03.10 and 03.21 sections, this chapter.

   b. Review the specific procedure, for the configuration of available gear as described below.

   c. Use normal landing flap extension for all landings, regardless of gear configuration, to afford lowest possible landing speeds.

   d. When runway foaming operation is complete and ready to commit aircraft to landing:

      (1) Plan to jettison ALL fuel tanks to minimum level.
      (2) Scavenge inboard tanks EMPTY for all available gear configuration landings.
      (3) When specific procedure calls for a wing heavy condition, the heavy wing should have only such additional fuel as indicated by the IN FLIGHT ASYMMETRIC FUEL DISTRIBUTION chart in chapter 02 of this handbook.

EXAMPLE

With inboard tanks EMPTY, and the outboard main tank with the least fuel at 3000 pounds, the maximum fuel allowed in the opposite main tank would be 7200 pounds in flight.

2. BOTH MAIN GEAR EXTENDED AND NOSE GEAR RETRACTED

   a. Seat passengers as far aft as possible.

   b. Make normal approach and landing on main gear.

   c. After touchdown, retract wing flaps at approximately 110 KTS IAS to increase elevator effectivity; retrim stabilizer as necessary.

   d. Avoid excessively nose high attitude.

   e. Lower nose gently to runway at approximately 100 KTS, as elevator effectiveness decreases rapidly below this speed.

   f. Do not use brakes, if conditions permit, until nose is on runway.

   g. When nose contacts, maintain directional control and stop aircraft with brakes.

CAUTION
DO NOT USE REVERSE THRUST.

   h. At END OF ROLLOUT, initiate engine shutdown and evacuation procedures.

3. NOSE GEAR ONLY EXTENDED

   a. Make as flat an approach as possible.

   b. Make initial contact on aft fuselage. Then lower nose gear to runway.

   c. At TOUCHDOWN, initiate engine shutdown procedure.

   d. When aircraft stops, initiate evacuation procedures.

4. ONE MAIN GEAR AND NOSE GEAR EXTENDED

   a. Distribute fuel (using crossfeed, jettison and scavenge procedures) so that wing with extended gear is heaviest.

   b. Make normal approach and landing.

   c. At TOUCHDOWN, initiate engine shutdown procedures for engines on wing with gear UP.

   d. Raise speed brakes slowly to reduce landing distance.

   e. Use nose steering, rudder and brakes and reverse thrust on the gear DOWN side to stop aircraft.

   f. Ease wing down till outboard pod contacts while aileron control is still available and effective.

   g. Apply FULL braking and reverse thrust on operating engines to stop aircraft.

   h. At END OF ROLLOUT, initiate engine shutdown procedure for remaining engines and evacuate aircraft.

5. ONE MAIN GEAR ONLY EXTENDED

   a. Distribute fuel (using crossfeed, jettison and scavenge procedure) so that wing with extended gear is heaviest.

   b. Make normal approach and touchdown.

   c. At TOUCHDOWN, initiate engine shutdown procedures for engines on wing with gear UP.

   d. Lower NOSE gently to runway while aileron and elevator control is still effective.

NDING WITH AVAILABLE GEAR (Cont'd)

CAUTION

IF ENGINE POD IS ALLOWED TO CONTACT FIRST, NOSE MAY BE PITCHED DOWN WITH EXCESSIVE FORCE.

e. After touchdown, extend speed brakes for additional drag.

f. When aircraft stops, initiate engine shutdown procedures on remaining engines and evacuate aircraft.

. BELLY OR POD LANDING

a. Make as flat an approach as possible.

b. Use full flaps for lowest touchdown speed.

c. Make initial contact on aft fuselage, then lower nose gently until inboard pods contact runway.

d. Immediately after TOUCHDOWN, initiate engine shutdown procedure.

e. When aircraft stops, initiate evacuation procedures.

LTERNATE BRAKING

1. AFTER NO. 2 HYDRAULIC SYSTEM FAILURE, BRAKE PRESSURES CHECK . . . . CHECK
With a loss of No. 2 system pressure and the brake pressure gauge indicating 3,000 PSI, the brake accumulator will provide at least seven full main gear brake applications. At least three full applications are available from the air brakes with 1,600 PSI indicated.

2. AFTER TOUCHDOWN:

a. #3, #4 & AUX HYDRAULIC PUMPS ON
Turn on the Auxiliary hydraulic pump and the engine driven pumps in #2 hydraulic system as the aircraft touches down. With any fluid remaining in the system, brake pressure can be maintained for a longer period of time.

b. USE ONE TOE BRAKE APPLICATION TO STOP AIRCRAFT
Due to the absence of a definite feel for anti-skid cycling, attempt to stop the aircraft with only one brake application rather than repeated Pumping of the brakes. This will use a minimum amount of fluid from the accumulators when stopping the aircraft. Although nose wheel brakes will be available, do not attempt full pedal deflection just to obtain nose braking.

3. IF TOE BRAKES INEFFECTIVE:
Have First Officer call out hydraulic brake pressure and if pressure drops to approximately 900 PSI, the Captain should be ready to use the Emergency Air Brake system. If Emergency Air Brakes must be used proceed as follows:

a. RELEASE TOE BRAKES
If necessary to use the Emergency Air Brake system, do not use toe brakes, even though nose wheel braking may be available. To do so will probably result in locking the main gear brakes by trapping air in the brake lines.

b. METER AIR BRAKES AS REQUIRED
Rotate air brake control slowly to prevent excessive air application initially as this may lock wheels and cause tires to blow out.

To maintain directional control at high speeds, use rudder and differential reverse thrust. At low speeds, use differential reverse thrust.

CSD MALFUNCTION LIGHT

1. IF ANY GENERATOR RELAY LIGHT ON, DISCONNECT . . . . DISCONNECT
If the malfunction light is accompanied by a tripped field and line relay, on the same generator, disconnect the CSD. If the bus tie relay is also tripped, reclose the bus tie before disconnecting the CSD.

2. IF NO GENERATOR RELAY LIGHT ON:

a. FIELD SWITCH TEST

b. CHECK FREQUENCY

c. IF FREQUENCY ABNORMAL, DISCONNECT . . . . DISCONNECT

d. IF FREQUENCY NORMAL MONITOR GENERATOR CONDITION
Return field switch to OFF and monitor light. If light goes out, leave the generator connected for use as a standby.

3. IF MALFUNCTION LIGHT REMAINS ON FOR ONE MINUTE, DISCONNECT . . . . DISCONNECT

GENERATOR OVERHEAT LIGHT

Anytime the Generator Overheat light comes On, use the following procedure to determine if it is necessary to disconnect the CSD.

1. FIELD SWITCH OFF . . . . OFF

2. IF OVERHEAT LIGHT GOES OUT:

a. LINE SWITCH OPEN. . . . . OPEN
This allows the generator to be operated without powering its load bus and the sync bus.

b. FIELD SWITCH ON . . . . ON
The field switch On allows the voltage and frequency to be monitored.

c. MONITOR GENERATOR CONDITION
If any of the indications are abnormal in standby the generator should be disconnected.

3. IF OVERHEAT LIGHT REMAINS ON FOR ONE MINUTE, DISCONNECT . . . . DISCONNECT

W. ASYMMETRIC SPOILER OPERATION

1. Asymmetric spoiler operation could be caused by slow or uneven operation of the spoiler linear actuators due to cold soak. Under cold soak conditions it may require as much as one (1) minute, or more, for the actuators to run full travel, or they may not operate at all.

2. Therefore, should a roll be experienced when attempting to pitch trim the aircraft with spoilers:

   a. Return the speed brake lever to SPOILER DOWN position, leave the spoiler selector switch in desired trim direction for approximately one minute.

   b. Again extend the speed brake lever. If roll persists, repeat step "a" two or three times.

3. If further attempts to pitch trim result in roll, leave the spoiler selector switch in the desired trim position and pull the appropriate CB (B-7) for the spoiler actuators in question. Wait five minutes for the actuator integral overload protector to cool and reset before repeating the procedure.

4. An alternate means of correction is to descend into higher temperatures and allow sufficient time for the actuators to warm up.

X. JAMMED SPOILER PROCEDURE

If a spoiler should jam in an extended position during flight, the resultant roll can be readily controlled by use of opposite lateral control and the application of spoiler speed brakes to equalize spoiler extension.

NOTE

On aircraft with Spoiler Control Overload lights installed the steady illumination of a light, in addition to the roll caused by a spoiler remaining extended, will confirm that a spoiler linkage is binding. If either light should illuminate steady or momentarily with no lateral trim change noted, closely monitor lateral control response and continue flight to destination. Flight with autopilot engaged under these conditions is not recommended.

Once the aircraft is returned to level flight, attempt to retract faulty spoiler by use of spoiler selector as follows:

1. Place spoiler selector NOSE UP (inboard spoilers retracted). If any tendency to roll noted, place spoiler selector to NOSE DOWN. This will leave symmetrical inboard spoilers extended and outboard spoilers retracted.

2. If, when placing spoiler selector to NOSE UP, no roll rate is noted, place to NOSE DOWN. If roll rate noted, return spoiler selector to NOSE UP which will leave inboard spoilers retracted and outboard spoilers extended.

3. If, when using the spoiler selector to determine which set of spoilers is at fault, the aircraft does not try to roll with either set of spoilers retracted, the spoiler selector system is retracting the faulty spoiler. Completely retract all spoilers by slowly moving spoiler speed brake handle toward 0° and place spoiler selector in the position (nose up or nose down) that will eliminate any roll tendency.

Leave spoiler selector in this position until after touchdown on landing.

4. Set bug to boundary speed + 10 KTS.

5. For landing, enter traffic pattern with gear down and wing flaps at 30° at bug speed + 10 KTS.

6. Reduce speed to Bug after turning on final approach and maintain this speed over the threshold.

WARNING

SINCE THE AIRCRAFT DECELERATES MORE RAPIDLY WITH EXTENDED SPEED BRAKES, EXERCISE CAUTION WHEN THRUST IS REDUCED FOR LANDING.

Y. JAMMED AILERON CONTROL WHEEL

Should either pilot experience a locked or jammed aileron wheel condition, the control system is designed to provide limited lateral control. In order to regain positive lateral control and evaluate the situation immediately, the following procedure should be instituted:

BOTH pilots apply as much corrective force as is necessary to overcome the aileron control interconnect spring and provide available lateral control.

1. If Captain's control wheel alone can be operated, only ailerons are available for lateral control. In this condition, if lateral trim is necessary:

   a. Apply spoiler speed brake gradually.

   b. If unable to trim with spoiler speed brake:

      (1) Select NOSE UP with SPOILER SELECTOR switch.
      (2) Pull SPOILERS EMER PITCH INBD circuit breaker B-7.
      (3) Select NOSE DOWN with SPOILER SELECTOR switch.

      The preceding steps should deactivate and stow ALL spoilers, provided the control problem exists in the linkages inboard of the spoiler linear actuators.

2. If First Officer's control wheel alone can be operated, only spoilers are available for lateral control.

   If Captain's control wheel jammed in a displaced position, continuous opposite control input must be maintained at the First Officer's wheel to keep wings level. No means of lateral trim is available in this situation.

3. Whenever either aileron or spoiler lateral control is not available, consideration should be made regarding the roll capability limitations that exist. Landings under crosswind conditions should be avoided where possible.

Z. CARE FOR VICTIM OF ELECTRICAL SHOCK

If the victim has suffered electrical shock, direct one of the crew to call a physician, if practicable and take the following steps immediately:

1. Remove source of electrical current by opening all field relays or turning ground power off.

2. If victim is unconscious and breathing has stopped or is intermittent, apply artificial respiration without delay. (Mouth-to-mouth resuscitation recommended).

CARE VICTIM OF ELECTRICAL SHOCK

WARNING
A DELAY OF 5 SECONDS MAY BE FATAL.

Use blankets or coats to keep victim warm.

Continue artificial respiration until natural breathing is restored unless advised otherwise by a physician.

WARNING
DO NOT STOP ARTIFICIAL RESPIRATION IF VICTIM'S BODY BECOMES STIFF OR RIGID. THIS CAN BE EXPECTED IN CASES OF ELECTRICAL SHOCK.

Do not attempt to move victim until natural breathing has been restored, unless his position jeopardizes the safety of the aircraft.

THRUST REVERSER ACTUATION IN FLIGHT

The following procedures, as they fit the situation, should be used to control or eliminate the affect of in-flight thrust reversal. Deliberate use of reverse thrust is prohibited.

Unless positive indications exist requiring immediate action to control the aircraft, a cross-check of cockpit instruments should be conducted to confirm warning light indication. An engine actually in a reversed condition should show a thrust reverse light, produce a yaw in a reverse direction if power is applied, have no indication of EPR on the instrument regardless of power setting and have only reverse throttle available to the pilot. An engine showing an in transit light for an appreciciable period of time should normally also have its throttle locked in the idle range due to the linkage arrangement associated with the controls. An in transit indication with the throttle in a forward thrust producing position that does not also produce a yaw should be considered a false indication.

If thrust reverser is inadvertently actuated in flight:

Reduce speed consistent with aircraft weight, altitude and turbulence conditions.

Rotate thrust reverse lever forward.

Check thrust reverser lights for normal indications that thrust reverser is properly stowed.

Carefully advance throttle to forward thrust position.

If cockpit indicators and aircraft reaction to thrust application is normal, proceed with flight. If any abnormality exists which could indicate damage, land at the nearest suitable facility.

If thrust reverser actuates due to an unknown cause:

Move throttle to idle position.

Place start lever to OFF.

Reduce speed consistent with aircraft weight, altitude and turbulence conditions.

Land at nearest suitable facility.

Do not attempt to operate the affected engine for remainder of flight.

CABIN WALL FIRE CONSIDERATIONS

The following information is provided as a guide to combat a fire in the cabin wall. Reported smoke or fire from galley units, passenger chairs or other accessible furnishings can best be extinguished by portable fire extinguishers. It is imperative that a cockpit crew member personally investigate any report of smoke or fire in the cabin, regardless of location or type described.

To sucessfully combat a cabin wall fire action must be initiated immediately. Cabin linings and fabrics meet existing requirements of flame resistance and propogation rate; however, they are not fireproof and can cause significant smoke.

Due to the wide variance in location and severity of possible situations, it is suggested that the captain analyze the reported conditions and initiate such action necessary to extinguish the fire or maintain control until a landing can be accomplished.

The following general actions are recommended where applicable:

Have crew members on flight deck use protective oxygen and interphone immediately. Crew member fighting the fire should use portable protective oxygen.

Advise passengers to remain seated unless requested to assist and that cabin lights may be off depending on the situation.

Proceed to the nearest suitable landing facility; maintain contact with ground and request that information be relayed to intended landing site.

Descend to 10,000 feet or below, terrain permitting, to allow depressurization of aircraft should structural damage result from fire. If descent is decided upon, shut down pressurization air sources progressively until only one remains in operation; this limits the airflow through the cabin wall area to the minimum necessary to sustain cabin pressure while above 10,000 feet.

The cabin wall fire may have been kindled by a short circuit or overheated electrical device or by careless handling of cigarettes or matches in the cabin area. If an electrical source is suspected the pertinent steps of the Electrical Fire procedure on the Emergency checklist should be accomplished at once.

The technique of fighting the fire in the cabin area will vary with the circumstances. The crew member proceeding to the area ←should carry the CO_2 fire extinguisher, ax, and flashlight from the cockpit. It is recommended that he then request additional items, such as portable oxygen and additional fire extinguishers, be brought to him by the cabin attendants. Passenger portable oxygen bottles stowed in the fire area should be removed to a safe place.

It may be necessary to remove a wall panel to gain access to the fire. A suggested method for rapid removal is to strike the center of the panel above the floor louvre sharply with the foot or the handle of the ax, then pry at the edge of ←the panel exposed by the resulting deformation. Do not chop at wall panel with the ax; damage could occur to fuselage skin, wiring or plumbing.

CABIN WALL FIRE CONSIDERATIONS

8. It is imperative that the fire be fought at as close a range as possible. Don the smoke mask, if necessary to allow getting near the fire area. Direct CO_2 through the available wall openings; water extinguishers are most effective when directed onto the burning material. Use caution with water extinguishers not to direct the stream onto electrical equipment.

9. After the fire is subdued it should be monitored for the remainder of the flight. Examine the area near the fire and quench any remaining embers. The surrounding area should be examined for skin or structural damage and, if present, require extreme caution on the part of the crew for the remaining portion of the flight. Avoid abrupt maneuvering do not pressurize the aircraft and proceed to the nearest suitable facility for landing.

10. Restore electrical power, if it was shut down during the fire fighting period, to all unaffected circuits. If wiring or electrical equipment damage is suspected, restore necessary load busses one at a time. A crew member should observe the damage area while electrical power is being restored to avoid re-kindling. Any circuit breaker or fuse found tripped or blown should not be re-set or replaced without careful analysis of the possible results. It is recommended that only absolutely essential items be restored.

11. If the fire is of appreciable magnitude the oxygen lines in the cabin area may become vulnerable. Consideration should be given to shutting off the cabin oxygen supply at the bottle or valve; this is especially important if depressurization has caused the automatic oxygen system to activate.

. **EN ROUTE LOSS OF CREW OXYGEN SUPPLY**

When the fixed oxygen supply becomes depleted during flight the crew becomes vulnerable to both smoke or loss of cabin pressurization, due to loss of primary protective oxygen.

The following steps should be accomplished to provide the greatest margin of safety available under the circumstances:

1. Place the cockpit portable oxygen bottle and mask in a position readily available to the captain.

2. Procure two portable oxygen bottles and masks from the cabin and place them in positions readily available to the first officer and engineer.

3. Plan to land at the nearest suitable airport in point of time.

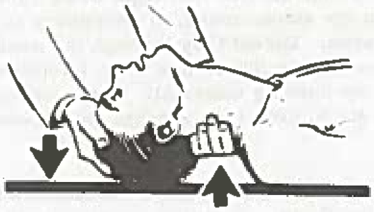
4. Analyze the possibility of descending to a lower altitude, considering available fuel versus time to destination selected. Descent should be a secondary consideration to maintaining adequate fuel reserve, particularly on overwater flights or when traversing widespread areas of poor terminal weather.

5. Specifically review Smoke Removal and Rapid Descent procedures, this chapter, to lessen the possibility that the lack of communication cause a coordination problem should either of them be required during the remainder of the flight.

RTIFICIAL RESPIRATION AND EXTERNAL HEART COMPRESSION

OPEN AIR PASSAGE

1. Clear mouth of foreign matter.
2. Lift up on back of neck and extend the head.



RESTORE BREATHING

1. Pinch the nostrils shut.
2. Place your mouth firmly over victim's mouth.
3. Blow hard enough to make victim's chest rise.
4. Remove your mouth to permit exhalation.

Repeat ever 5 seconds.

- If victim is a CHILD:

1. Cover both nose and mouth with your mouth.
2. Blow shallow breaths.

Repeat ever 3 seconds.

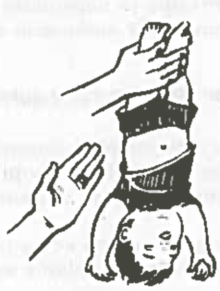
- If there is NO AIR EXCHANGE:

ADULT

Turn victim on his side . . .

CHILD

Hold child with head down . . .



INFANT

Hold infant by heels . . .

. . . . and slap him sharply several times between the shoulder blades in order to dislodge any foreign matter from the throat.

RESTORE CIRCULATION

The HEART has STOPPED if; pupils are dilated or no pulse is noted.

1. Place heel of hand over lower half of breast bone.
2. Press down 1 1/2 to 2" and release.

Repeat every second.

If victim requires both mouth-to-mouth respiration and external heart compression:

ONE RESCUER: Alternate between inflating the lungs twice and compressing the heart 15 times.

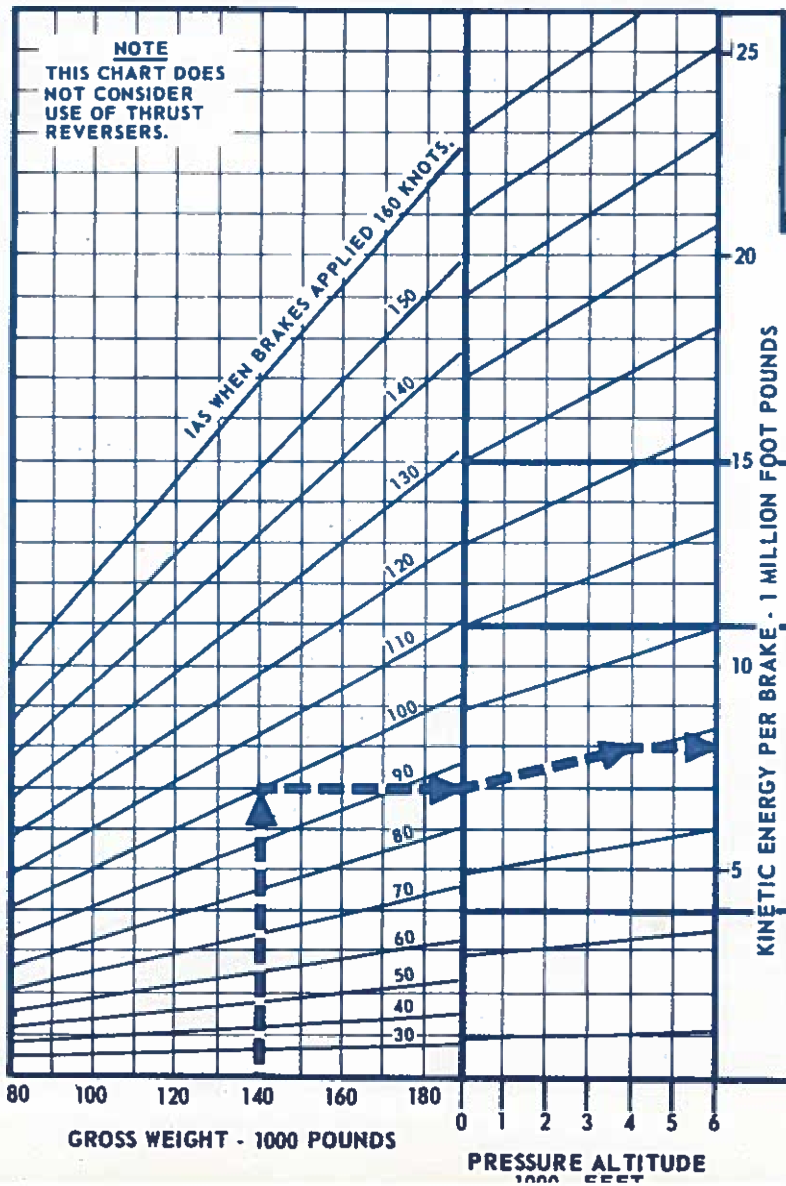
TWO RESCUERS: Inflate lungs on the release of every 5th external heart compression.

Many persons have been revived only after hours of artificial respiration.

* * *

(4354)

PURPOSE OF THIS CHART IS TO AVOID IN-FLIGHT FIRES AND INSURE ADEQUATE BRAKE CAPACITY FOR A REJECTED TAKEOFF.



GIVEN:

Full stop landing.
Gross Weight - 140,000 lbs.
Airspeed when brakes applied - 100 KTS IAS.
Pressure altitude - 4000 FT.
No thrust reverser.

FIND:

Are brakes safe for another takeoff.

SOLUTION:

Following example line, the K.E. per brake - 8 million foot-pounds this is 4 million foot-pounds in excess of 4 million foot-pounds per brake. Therefore recommended ground cooling period prior to subsequent takeoff is 24 minutes (4x6 minutes - 24 minutes).

DANGER ZONE-ABOVE 15 MILLION FT/LBS

1. Clear runway immediately after stop since tires will deflate.
2. Do not set parking brake.
3. Alert fire extinguishing equipment for hydraulic fluid, grease or tire fire. Dry chemical extinguisher preferred, fog or foam acceptable.
4. If one or more tires remain inflated, approach cautiously from front or rear only and avoid spraying extinguisher or coolant directly on inflated tire and wheel.
5. Fog or foam may be used for cooling, otherwise 2 to 3 hours are required for brakes to be cool enough for safe removal.
6. Mandatory tire, wheel and brake replacement.

CAUTION ZONE-11 TO 15 MILLION FT/LBS

1. Park airplane but do not set parking brakes.
2. Do not approach for 1/2 hour.
3. Delay subsequent takeoff for 1-1/2 hours, or until hand can be held on brake housings.
4. Before second takeoff, make complete visual check with pressure on. Check for brake seal leakage and tire damage (melting or charring at bead seat). Actuate brakes fully 5 or 6 times and during final application check for leaks. Check for wear per decal on brake.

NORMAL ZONE -4 TO 11 MILLION FT/LBS

1. Delay subsequent takeoff 6 minutes for each one million ft-lbs in excess of 4 million, or:
2. If immediate takeoff is made; after clean-up height is reached and flaps are retracted, extend gear and leave down for 2 minutes for each 1 million ft-lbs in excess of 4 million.

BELOW 4 MILLION FT/LBS

No special procedure required.

(3931)

* * *

EVACAUTION ALARM POLICY

The variable nature of each emergency landing and/or emergency evacuation makes it impossible to set down definite procedures. Therefore, the procedures in this section are guidelines only. Proper evaluation of the situation will dictate the course of action to be followed.

Emergency landings or other abnormal conditions do not always dictate the need for an emergency evacuation. However, if conditions are such that an evacuation appears necessary, the first crew member aware of this situation shall immediately advise the captain. The captain will evaluate the situation and, if necessary, will initiate the evacuation. If time does not permit contacting the captain because the nature of the emergency requires immediate action, the crew member will activate the evacuation alarm system without further delay.

When the evacuation signal sounds while the aircraft is taxiing, the captain will immediately stop the aircraft and shut down the engines.

CREW DUTY CHART

EMERGENCY LANDING

BEFORE LANDING	AIRCRAFT EVACUATION (if required)
CAPTAIN Transmit emergency message. Instruct flight attendants, first officer, engineer and ACM. Brief passengers. Have cabin alerted 30 seconds before touchdown.	Parking Brake . . . . ON Start Levers . . . . OFF Spoiler Handle . . . . DOWN Emergency Lights . . . . ON Evacuation Alarm . . . . ON Engine Fire Pulls . . . . PULL Engine Fire Ext. . . . . Discharge (If Req.) Direct Evacuation
FIRST OFFICER As directed by captain.	Check forward right door activated. Expedite evacuation in forward cabin.
ENGINEER Subject to captain's discretion: Secure cockpit station. Take aisle seat aft door area.	Expedite evacuation in aft cabin.
FLIGHT ATTENDANTS	
FLIGHT ATTENDANT A Go to cockpit for captain's instructions. Brief other attendants and passengers. Coordinate all cabin preparation. Advise captain when completed.	Open forward left door. Expedite evacuation.
FLIGHT ATTENDANT B Assist in cabin preparation.	Four or more F/A's - Open forward right door. Three F/A's - Open aft right door. Expedite evacuation.
FLIGHT ATTENDANT C Assist in cabin preparation.	Open aft left door. Expedite evacuation.
FLIGHT ATTENDANT D Assist in cabin preparation.	Open aft right door. Expedite evacuation.
OTHER ATTENDANTS Assist in cabin preparation.	Expedite evacuation.

NERAL

ɔossible emergency in its early stages may not be well defined. ıncertain whether a distress alert is in order, it is better to :lare the emergency. It can always be cancelled later if it is needed. When confronted with an emergency situation, alert appropriate traffic control center immediately.

e following procedures are to be used only as a guide since :h emergency situation will have its own unique conditions. ew members must be prepared to initiate, or assist in air- ıft evacuation irrespective of their assigned duties.

ACUATION SIGNALS

ıenever possible, the captain should initiate the aircraft acuation if it becomes necessary. Crew members who ob- rve a potential emergency condition should tell the captain mediately. This gives the captain a basis for evaluating ether the situation warrants aircraft evacuation. If necessary, will activate the evacuation signal. However, there are sit- tions, such as explosions or uncontrollable fires, which will quire immediate evacuation. Any crew member who observes s sort of situation will activate the evacuation signal since ne will not permit contacting the captain first.

ıe evacuation process will be seriously impaired if the engines e running or the aircraft is moving. Therefore, any time an acuation is anticipated or the evacuation signal sounds, the rcraft must be stopped and the engines shut down immediately.

ıusual occurrences may cause concern among passengers and ght attendants as to their safety, and could result in unwar- nted evacuation. To avoid this possibility the captain should ake a PA announcement to tell them that the situation is under ntrol.

:CAPE ROUTES

ıe four cabin doors are the preferred escape routes for land acuation. Additional escape routes are the overwing and ıckpit window exits. In a water evacuation the overwing exits e the preferred escape routes.

/ACUATION PLAN

ıe general evacuation plan consists of the flight attendants ɔerating their respective doors and slides. The flight crew deployed throughout the cabin to command and direct the acuation.

is not intended that crew members assume unnecessary risks. hen everything possible has been done to provide for passenger ıfety, they should leave the aircraft without delay.

he ranking crew member is responsible for command of the ıtire group. The ranking crew member present will assume ɔmmand and exert forceful direction.

nce an aircraft evacuation is started, it may be stopped only ı command of the ranking crew member.

OMMUNICATION

ransmit the emergency message and any additional information : request on the ATC frequency in use at that time. The emer- ency message should include:

Flight number and position.
A description of the emergency and your intended action.
The kind of assistance desired.

If unable to establish communications, set the transponder on code 7700 and broadcast the following message as often as possible:

"Mayday, mayday, mayday.
This is TWA flight ______."
Emergency message text.
Depress the microphone button for two second intervals.
"This is TWA flight ______, OVER."

BEFORE LANDING

CHECK LIST

Initiate the check list procedures as indicated in the Anticipated Crash Landing portion. This section intends to prepare for landing in conditions other than normal. Some of the items may be impossible, or not desirable to accomplish. The degree of conformity will be consistent with command evaluation.

INSTRUCT THE FLIGHT ATTENDANTS

Flight attendant A should be summoned to the cockpit by PA announcement or the 6 bell signal.

Explain the nature of the emergency, and approximately how much time is available. Review what sort of cabin preparation should be made and any expected adverse evacuation conditions; wind, terrain, structural damage.

Specific instructions for cabin preparation are in the flight attendants Emergency Procedures Handbook.

It is desirable for the captain to brief the passengers. If the situation makes this impossible, the flight attendant will brief them using the passenger address system. If the PA is inoperative, the flight attendant will use the megaphone.

INSTRUCT THE ACM

If an additional crew member is in the cockpit, direct him to be seated in the cabin in a location where he can assist one of the flight attendants. If no seats are available in the cabin, the additional crew member should be assigned a duty station and told to get to it immediately after the aircraft stops.

LANDING ALERT

Instruct the passengers to assume the emergency landing position approximately thirty seconds before landing and to remain in that position until the aircraft comes to a stop.

LANDING AREA EVALUATION

In all cases at an airport, landing on a runway is considered preferable.

In situations involving a belly or partial gear landing, foam will reduce ignition potentials. Friction reduction is slight so that runout distances will not be significantly increased.

The value of foam is to provide spark and heat quenching. If the entire runout track cannot be covered, it is desirable that the aircraft stop in the foam pattern.

To allow sufficient time to foam a runway, whenever foam is required, contact the tower of the field of intended landing as early as possible stating runway foaming requirements.

A landing in open terrain is a matter of selecting the best approach and runout condition consistent with time and maneuvering ability.

POST LANDING

When aircraft evacuation is required, stop the aircraft and place parking brakes on and start levers off. If the emergency lights are not on, turn them on and turn on the evacuation alarm. Pull the engine fire pulls, and discharge fire extinguishers if required.

If engine fire location is known, direct both bottles to that engine. If there is no indication of fire, direct one bottle to each engine.

Proceed to cabin area. Supervise door opening and evacuation slide activation. Command and motivate passenger escape movement.

ON GROUND

The ranking crew members will determine that all passengers are accounted for. Direct the passengers away from the aircraft and inform them to stay in one group.

DO NOT:

Disturb or allow to be disturbed any wreckage or cargo.

Make any statement concerning the possible cause of the accident.

Prevent news photographers from taking photographs.

Discuss anything about insurance.

Do or say anything that might imply that the company is admitting liability for any injury or damage.

* * *

A. **GENERAL**

Emergency equipment for the 880 aircraft includes, emergency lights, fire extinguishers and first aid kits for use in the event of in flight or landing emergencies. Escape ropes, escape slides and a crash axe are installed to assist in abandoning the aircraft or aid in rescue operations.

B. **EMERGENCY EXITS**

The two main entry doors, two galley service doors, two overwing escape windows and the two sliding windows in the cockpit are considered emergency exits. Instructions for opening the doors, escape hatches and cockpit windows are displayed on the inside and outside of each of the above openings. An inflatable escape slide is provided at each main entry and galley door to evacuate passengers quickly and safely to the ground. Passengers may also be directed through the escape hatches and on to the wing. Ropes attached to the window frames may provide assistance for deplaning over either edge of the wing. The cockpit can be evacuated through the passenger cabin or, using the escape ropes provided for each window, through the cockpit sliding windows.

C. **EMERGENCY EXIT LIGHTS**

Placing switch to RESET, with essential D. C. power on the bus, will turn the lights on and will rearm the two deceleration switches in the event either or both were tripped. Tripping of either deceleration switch will cause the respective sets of lights (cabin or cockpit) to come ON regardless of switch position.

Returning the switch to OFF will cause all exit lights to come ON with the loss of essential D. C. power. Lights will also come on on impact.

With the switch in SHUTDOWN, none of the exit lights will come on with the loss of essential D. C. power. However, with essential D. C. bus power available, the cockpit dome lights and cabin emergency exit lights can be manually turned on at the cockpit and Cabin Attendant stations, respectively.

NOTE

Cabin Attendant has no control of cockpit emergency lights.

D. **EVACUATION LIGHTS - (BULKHEAD & OVERHEAD RACK)**

The evacuation lights are dual lens, individual package installations placed in strategic locations in the cabin to provide general cabin lighting in the event of an emergency landing and the aircraft lights are inoperative.

Units are self-powered by batteries and incorporate impact switches which will be activated by any 1.5G force in a horizontal plane.

A two-position switch is provided on the face of each unit between the two lights. The up position is labeled AUTOMATIC and the down position is labeled MANUAL.

The switch is normally carried in the AUTOMATIC position but the lights may be turned on by placing the switch to MANUAL. Should the lights inadvertently come on automatically for any reason and they are not needed, placing the switch from AUTO to MANUAL and returning to AUTO will serve as a reset function and the lights should again go out.

E. **FIRST AID KIT**

One first aid kit is stowed in a small compartment above the aft Cabin Attendant's forward facing aisle seat.

F. **FIRE EXTINGUISHERS**

Two portable CO_2 fire extinguishers are installed on the aircraft. One is in the cockpit and one on the forward side of the left-hand rear galley bulkhead. These extinguishers are activated by pulling the trigger (which breaks the safety seal) and releasing CO_2. Effective range is approximately three feet and the supply will fully discharge in 15-30 seconds.

Two water type fire extinguishers are installed. One is located in the forward coat compartment and one on the forward side of the left-hand aft galley bulkhead.

The water type extinguisher is activated by rotating the handle clockwise. This breaks the safety seal, releases CO_2 into the cylinder to pressurize it and also moves the collar far enough to release the trigger. Pressing down on the trigger releases the water in a stream which is effective up to 10 feet. It will fully discharge in 30-45 seconds.

G. **CRASH AXE**

A crash axe is stowed on the forward side of the cockpit to cabin door.

H. **EMERGENCY ESCAPE SLIDE**

1. Four inflatable escape slides are installed in stowage spaces faired into the bulkheads immediately forward of each passenger and galley door. One slide for each passenger door and one for each galley service door.

2. To activate escape slides, proceed as follows:

   a. Open cabin (passenger or galley) door and lock open against side of fuselage.

   b. Pull panel release handle and drop to extent of retainer strap.

   c. Press panel down sharply to separate quick disconnect on retainer strap and allow panel to fall to floor. This action automatically releases the slide from its outer cover.

   d. Push or kick slide overboard.

   e. Pull sharply on the air release handle which should be visible inside the bulkhead housing. Slide should inflate in approximately 9 seconds.

   f. Proceed with evacuation.

I. **ESCAPE ROPES**

Escape ropes are located above each emergency wing exit. They are contained in tubes in the cabin ceiling circumference and are attached to cabin structure in the upper exit frame. Ropes may be used to assist personnel from either the leading or trailing edge of the wing.

One rope is located at each cockpit sliding window. These ropes are secured to the structure aft of each pilot console.

A red hook is provided above the sliding panel through which the rope must be placed when deployed.

One additional loose rope is stowed in the forward coat closet.

. SHOULDER HARNESS

The shoulder harness is designed to give freedom of movement during normal operating conditions while automatically locking the harness during an abrupt deceleration. The inertia reel is factory adjusted to lock at 2 to 3 G's abrupt deceleration.

Inertial type reels are installed on the Captain, First Officer and Flight Engineer seats. The release button is located on the inboard side of the Captain and First Officer's seat and on the left side of the Flight Engineer's seat.

The operation of the inertia reel may be checked at any time to check for proper operation. Grasp the shoulder harness straps and jerk them forward. This will lock the reel and prevent further forward movement but the reel will continue to take up any slack in the straps.

To release the lock, press the release button inward while exerting no pressure on the straps. The lock will not release unless the straps are relaxed. Regardless of the harness condition (locked or free) releasing the harness from the seat buckle will allow the shoulder harness to retract into the seat back. The harness may be released separately by pressing forward on metal tabs located at the top of the buckle.

K. SMOKE GOGGLES

Smoke goggles are provided at all crew member stations. The goggles utilize an amber lens to improve visibility in smoke conditions and are designed to be worn with the individual crew supplemental oxygen masks.

Two small plastic tubes connected to the goggles, provide an air passage between the supplemental mask and the goggles. These tubes are long enough to extend inside the supplemental mask when it is in place.

To use these goggles, proceed as follows:

1. Don the supplemental mask.
2. Put on smoke goggles and secure with the elastic headband.
3. Tip upper portion of the oxygen mask (nose cone) away from the face momentarily to allow goggle air tubes to assume the proper position beside the nose.
4. Reposition mask over nose and mouth making certain plastic tubes extend inside the mask.
5. Should it be necessary to clear the goggles (contaminated air or fogging), the oxygen regulator emergency valve may be used to provide continuous flow as required.

CAUTION

Extended use of continuous oxygen flow will rapidly deplete the oxygen supply.

L. PORTABLE MEGAPHONE

A self-contained, battery powered megaphone is installed on the shelf above the aft coat compartment.

To operate, squeeze the trigger located on the handle and speak normally into the mouthpiece. A volume control knob, on the back of the unit, may require adjustment to provide the desired voice amplification.

To prevent damage of the volume control stops, do not force the knob against the end of its travel in either direction. With the volume control knob set at 1:00 o'clock position, output should be sufficient to be heard throughout the airplane.

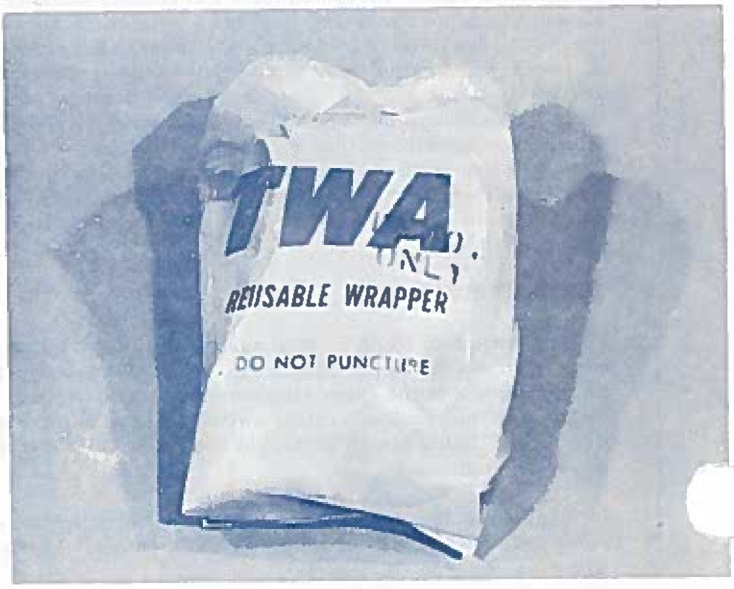
M. LIFE VESTS

Five life vests are located in the cockpit against the side wall aft of the Flight Engineer's panel for use in case of a crash on water.

Two life vests for the cabin attendants are stowed on the shelf above the forward coat compartment.

One additional life vest is located in a compartment above the aft facing hostess seat at the aft passenger door and one life vest is installed on the shelf above the aft coat compartment for use by "C" and "D" cabin attendants.

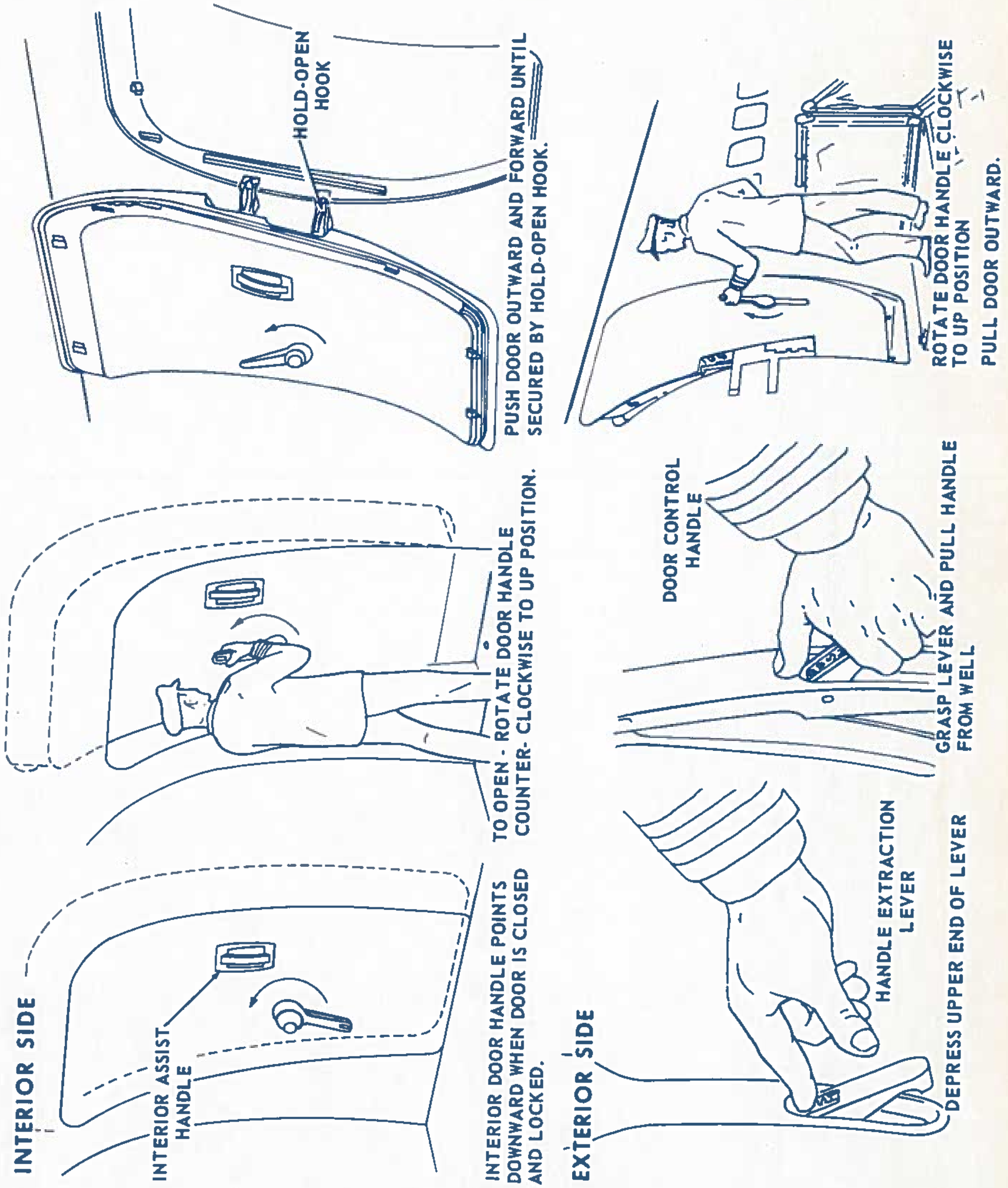
1. Description



(7061) WRAPPED LIFE VEST

(7062) FRONT OF LIFE VEST

C. DOOR OPERATION



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REPORTING ENGINE AND COMPONENT MALFUNCTIONS

In case a malfunction of any type occurs, all pertinent information should be recorded in the logbook. Whenever possible, all instrument readings before, during and after the malfunction is noted should be recorded. The report should also include the time:

Abnormal indications were observed.

Engine shutdown if applicable.

Engine operated at 0 oil pressure.

Engine windmilled at 0 oil pressure.

Engine windmilled.

Any trouble-shooting attempted and the results.

ENGINE STARTING WITHOUT EXTERNAL ELECTRICAL POWER

With the bleed air manifold pressurized, an engine on the right side must be started first without external electrical power by using the following procedure:

Turn OFF #1 and #4 Load Reduction switches, Recirculation Fan switch, and Freon Pack switches.

Place Battery switch to Emergency.

When ready to start the engine place Emergency Ignition Static Inverter switch ON.

After the generator takes over its load bus, place external power switch to PARALLEL.

An indication of engine oil pressure will now be available.

After generator power is applied to the sync. bus, return the Battery switch to NORMAL and Emergency Ignition Static Inverter switch to OFF. Check that the Emergency Ignition Power On light goes out when the switch is placed OFF.

After a second generator is operating in parallel, turn on #1 and #4 load reduction switches.

Turn on the recirculation fan switch.

If additional cooling is required for passenger comfort, a Freon system (cabin preferred) may be turned on when three generators are operating in parallel.

ENGINE STARTING WITH START VALVE OPEN LIGHT INOPERATIVE

If a start valve position light is inoperative, the normal procedure must be modified as follows:

No cross starting permitted.

Start the affected engine with all bleed valves closed.

Have ground personnel compare start cart duct pressure prior to starting and after starting affected engine to ensure its start valve closes.

CROSS BLEED STARTING

If the ground air supply fails after one engine has been started, or the start cart pressure is low, the remaining engines may be started by using the operating engine for a bleed air source. All start valve open lights must be functioning properly if a cross bleed start is used.

Accelerate an operating engine to maximum of 76% and open its bleed valve.

Start the remaining engines in the normal manner.

NO LIGHT OFF DURING ENGINE STARTING

When an engine fails to light off using the normal starting procedure, proceed as follows:

If there is no rise in EGT within 20 seconds after placing start lever to Run detent, place start lever OFF and continue engine rotation by holding start switch to GROUND for an additional 20 seconds to clear engine of residual fuel.

EGT ABOVE LIMITS DURING ENGINE STARTING

If the Exhaust Gas Temperature reaches 550°C:

Return the start lever to OFF.

Continue engine rotation by holding start switch to GROUND until EGT drops to safe value, 400°C or below.

If the EGT did not exceed the type II limit, raise the start lever to RUN and attempt another relight. The engine RPM should be higher on the second attempt which may result in a lower starting EGT.

If the EGT exceeded the type II limit, shut the engine down since the engine must be changed.

START VALVE FAILS TO OPEN

If the engine does not rotate when the starter control switch is placed to GROUND, the starter shutoff valve may be operated manually by applying air pressure directly to the valve pneumatic actuator.

If the starter valve is to be manually operated use the following procedure:

When ready to start the engine, captain notifies ground crew by interphone and commands "Energize Starter."

As soon as tachometer indicates that engine is rotating, first officer will place start switch to FLIGHT position, the captain will advance start lever to RUN, observe fuel flow and indication of light-off.

As engine accelerates, call out RPM over interphone to ground crew. At 45% RPM the man at the engine will release the starter shutoff valve, allowing it to close.

Do not accelerate engine above idle RPM until the ground crew has secured the cowling and are clear of the area.

HUNG START PROCEDURES

A logbook write up may be made if the engine fails to reach idle RPM within 2 minutes. Observe engine acceleration during the start. If acceleration stops before the engine reaches 60% RPM, and the fuel flow is above normal for idle, or EGT continues to increase, take the following steps immediately:

If the start switch is still being held in the GROUND position, move the start lever to OFF momentarily then back to RUN

If the start switch has been released, place the start switch to FLIGHT position and move the start lever to OFF momentarily then back to RUN.

START VALVE OPEN

If a start valve opens, or stays open with the start switch out of the GROUND position during ground operation:

ON GROUND

Place the appropriate wing isolation switch OFF

If the open start valve is on either #3 or #4 engines, have the ground air source removed prior to shutting down the engine. This is necessary to prevent starter damage.

IN FLIGHT

Place the appropriate wing isolation switch OFF

If the start valve open light goes out, leave the wing isolated.

If the start valve open light stays on, a fault in the light circuit is indicated and the wing isolation switch may be returned to AUTO.

IDLE RUMBLE

Idle rumble may be encountered on an engine during starting acceleration or up to approximately 75% RPM. It may be identified by audible sound as well as vibration felt through the throttle and start lever.

It is caused by cycling of the pressurizing piston in the pressurizing and drain valve, especially after air has been allowed to enter the system.

The frequency of the pulsations is low enough (approx. 20 cycles per second) that it may not cause an increase in indicated vibration. If rumble starts at or near idle speed, increase RPM until rumble stops. This will usually purge the air from the pressurizing and drain valve and correct the problem. If rumble cannot be cleared, engine must be shut down and pressurizing and drain valve changed.

ABNORMAL ENGINE OPERATION

ACCELERATION HANG-UP

Acceleration hang-up is a type of malfunction in which the engine fails to accelerate past a specific RPM. This hang-up sometimes occurs after the throttle has been retarded and attempt has been made to accelerate to a higher RPM. It sometimes occurs on the CJ-805 at high altitudes during relight attempts, especially if the windmill RPM is low and IAS is also low. Positioning start switch to FLIGHT and moving start lever to OFF and immediately returning it to RUN will usually correct the problem.

If hang-up occurs during acceleration above idle speed, retard throttle and re-open slowly.

LOW ACCELERATION RATE

The engine acceleration rate from idle to takeoff thrust is limited by the fuel control unit. If the engine is slow to accelerate it may be a fault of the fuel control, fuel limit cam or the speed sensing servo system. If engine can be accelerated at all, operate it through several cycles in an attempt to free up the speed sensing servo. If acceleration rate is still low, note in logbook the approximate time necessary to accelerate from idle to takeoff thrust.

LOW EPR AT TAKEOFF THROTTLE SETTING

If an engine fails to produce takeoff EPR at full throttle, check the full throttle RPM vs the maximum RPM column of the takeoff thrust setting chart in the Convair 880 Planning and Performance Manual. If RPM is low, it indicates a malfunction of the fuel control or its CIT sensor. (Fuel flow and EGT should also be proportionately low.)

ABNORMAL EGT INDICATIONS

Any malfunctions which affect components in the main gas path of the engine, will usually cause the EGT for a specific thrust setting to increase. Changes in the basic engine condition can be detected by changes in the relationship of RPM, EGT and Fuel Flow.

To determine the degree of change in engine condition, compare engine performance readings with previous logbook entries which were taken at the same thrust rating.

EXAMPLE

Cruise thrust readings from consecutive logbook pages. Any abrupt change should be investigated.

EGT spread between two engines operating at the same thrust setting should not exceed 30° C.

Turbine blade failures or turbine seal damage will generally show the following combination of indications:

EGT 15-40 degrees higher than previous.

Fuel Flow 100-300 pounds per hour high.

RPM 1-3% lower than previously noted, after EPR has been reset.

If these indications are observed, continued engine operation is not recommended since it exposes the engine to further damage.

NOTE

When making engine performance comparison, use the same conditions of bleed air flow if possible.

ENGINE VIBRATION

Vibration of the jet engine is not comparable to that of a piston engine because the vibration frequencies are a direct function of, or a multiple of the RPM and are therefore higher. At the same time the amplitude of the vibration is low since there are no reciprocating parts in the engine. Therefore, engine vibration will not usually be felt through the airframe until it becomes quite severe. In most cases the vibration can be felt through the throttle or start lever clearly enough to determine which engine is at fault.

ABNORMAL ENGINE OPERATION (Cont'd.)

Engine vibration can be isolated from aerodynamic vibration by changing the RPM of one engine at a time and noting change (if any) in frequency or amplitude. If vibration is severe and engine shutdown is considered, two possible sources of vibration may first be eliminated by depressurizing the hydraulic pump on that engine and by disconnecting the generator drive (CSD).

COMPRESSOR STALL

General

Engine compressor stall is possible in the jet engine because of the airfoil characteristics of the compressor blades. Compressor stall is an aerodynamic stall occuring in the same manner as that in which an aircraft wing stalls. This condition is caused by a reduction of airflow through the engine, which increases the effective angle-of-attack of the compressor blades, resulting in a compressor stall.

Anything that disturbs the relationship of RPM and airflow affects the stall margin of the compressor.

Compressor stalls vary in severity, depending on whether the stall involves only a portion of a stage, a complete stage, several stages, or an entire compressor. Incipient stall may produce roughness in engine operation with or without audible accompaniment of rumble, drone, etc. Severe stalls will produce audible pulsations similar to back firing of a piston engine, although much louder.

Acceleration Stalls

The fuel control unit is designed to avoid compressor stall during maximum rate acceleration and prevent flame-out during rapid deceleration. This unit also schedules the operation of the variable stators and inlet guide vanes. If the engine stalls during rapid acceleration, close the throttle and reopen slowly.

Any attempt to accelerate the engine rapidly during conditions where the airflow into the inlet duct is disturbed by high angle-of-attack, turbulence, ice accumulation, etc., may induce a stall.

Deceleration Stalls

The lowest stall margin of the compressor occurs at the stator break point, which is that RPM where the stators first reach the wide open position. If the stators do not close when the throttle is retarded below this RPM, a stall will result. Occasionally the engine will emit a buzz or growling noise during deceleration. This should be interpreted as a warning that it is approaching stall. If this is noted, stop throttle movement or reopen slowly and delay thrust reduction until lower RAT is reached. Do not exceed maximum time limitations for takeoff thrust rating. If the stall is caused by a temporary hangup of stator actuating mechanism, and does not repeat, the engine may be operated with no restrictions. If successive stalls occur, the engine should be shut down or operated above the stator break point RPM.

ENGINE SLOWS TO IDLE

Failures of the JFC drive shaft or the compressor discharge pressure sensing line will cause the fuel limiting system of the fuel control to reduce the fuel flow to the minimum flow setting of approximately 500 pounds per hour. Following this type of failure the engine RPM may decrease to less than idle setting of 60% and will not respond to changes in throttle position. If EGT is not excessive, the engine may be operated at this low power to provide generator or hydraulic pump operation or be shut down, SCD.

OIL SYSTEM, ABNORMAL INDICATIONS

Oil Pressure Increase

Oil pressure to the engine is a function of engine RPM, temperature and spray jet size. Clogging or opening of a spray jet is indicated by a change of oil pressure during a stabilized operating condition. Any oil pressure increase or decrease may be an indication of impending engine failure. Previous logbook oil system operating history should be reviewed and the engine written up for maintenance investigation if there is a pressure change during stabilized operating condition.

Oil Loss During Engine Windmilling

When the engine windmills excessive oil may remain in the sumps due to inefficient scavenging. Due to loss of carbon seal backup air pressure oil can then get into the air chamber around the sump. The oil will then be exhausted overboard when the engine is restarted.

A few minutes engine operation at high RPM may be necessary to clear the oil from the air chambers. During this time, oil and smoke can be expected from the engine breather and the 17th stage seal leakage outlets.

Excessive Oil Temperatures

The indicated oil temperature is the temperature at the outlet of the scavenge oil filter. Rapid increase in temperature is normally interpreted as a sign of mechanical failure in the engine.

The oil is cooled in an oil-to-fuel heat exchanger. If the fuel heater valve sticks in the full open position, it could induce high oil temperature. If oil temperature on one engine gradually increases above the average of the other three engines, check the fuel filter temperature for that engine, if it is also high, suspect failure of fuel heater valve.

NOTE

During operation of the engine anti-ice system, the engine oil temperature may increase as much as 10°C depending on OAT and the amount of thrust being used.

Fuel Heater Valve Failure

If the fuel heater control valve fails in the wide open position, the fuel temperature for that engine may exceed the maximum reading of the indicator. Although high fuel temperature is undesirable, it is not considered a hazardous condition.

Since fuel is used for oil cooling, the oil temperature and pressure should be monitored closely if the fuel temperature is excessive. A 15 to 20 degree rise in oil temperature and a 2 to 5 PSI drop in oil pressure can be expected. As long as oil temperature and pressure do not exceed limits, and engine RPM remain stable (no surging), no corrective action is required. If limits are exceeded or surging occurs, engine should be operated at reduced power or shut down.

ENGINE SMOKING AT SHUTDOWN

If white smoke or vapor appears at either the inlet or tail-pipe when the engine is shut down, it may be the result of the pressurizing and dump valve hanging up. The smoke is caused by fuel in the metered fuel manifold draining into the lower burner cans instead of dumping into the dump tank when the engine runs down after shut down. If this malfunction is indicated by smoke and vapor following shutdown on successive shutdowns, it may be necessary to change the pressurizing dump valve.

NORMAL ENGINE OPERATION (Cont'd.)

WARNING

Do not activate ignition while vapor is still present or an explosion may result.

ELING ADDITIONAL PROCEDURES

TERNATE FUELING INSTRUCTIONS-
OPERATIVE QUANTITY GAUGE

en a fuel quantity gauge is inoperative or is suspected to be ıding incorrectly, fuel level must be determined by the use :he drip sticks and verified on the correct charts for the craft.

he accuracy of a fuel quantity gauge is questioned, this ocedure can be used to verify the accuracy of the gauge in estion. If the drip stick reading is within plus or minus inch of the indicator reading, the gauge shall be assumed rrect.

use the drip stick measurement tables, the airplane must level along either the longitudinal axis or the lateral s. The degree of unlevel for the other axis must not ceed 2°.

EL LOAD CONVERSION TO GALLONS

After leveling the airplane in accordance with the preceding instructions, measure fuel density with test hydrometer in the following manner:

If the quantity of fuel serviced to the airplane is more than twice the quantity of fuel in the airplane prior to servicing, the density of the fuel serviced to the airplane should be used in converting the fuel load to gallons. Fuel samples should be taken from the hose (not the sump).

If the quantity of fuel in the airplane prior to servicing is more than twice the quantity of fuel to be serviced to the airplane, the density of the fuel in the airplane before servicing should be used in converting the fuel load to gallons. Fuel samples from the airplane fuel tank sump may be used if care is taken to avoid water content in the fuel sample.

If neither of the above two conditions is applicable, the density value should be computed according to the following equation.

$$\text{Average Density} = \frac{\text{Density of fuel serviced to airplane} + \text{Density of fuel in airplane before fueling}}{2}$$

Convert the total fuel release from pounds to gallons by dividing the fuel release by density.

RVICING

The minimum fuel release with #2 or #3 main tank indicating system inoperative is 27, 000 pounds (28, 000 pounds minimum ramp fuel).

Refer to Fuel Distribution chart, section 02. 09 for fuel distribution procedure.

After determining the fuel distribution in individual tanks in gallons, refer to the applicable Drip Stick Measurement table.

For fuel loads above 28, 000 pounds and the desired tank fuel unstickable, use the fuel truck meter to add the additional fuel necessary above the stickable range to obtain the desired tank quantity.

Set drip stick at correct level and secure the drip stick valve open with drip stick operating tool. Use drip stick collar as reference point.

NOTE

Fuel runs through the inner tank vent channel from tanks 1 or 4 main to 1 or 4 replenish at a level approximately 11, 000 pounds. The outboard main tanks are not actually full until approximately 2, 680 pounds of fuel is added to the respective replenish tank.

Outboard replenish tank levels above approximately 1, 340 pounds are not stickable.

Load fuel to tank until fuel drips from end of drip stick. Repeat for other tanks.

After servicing, check struts for proper inflation.

N. DRIPSTICK TABLES - OVERWING FUELING

NOTE

For each degree aircraft is out of level adjust Drip Stick Measurements in accordance with figures under NOSE UP, DN, and WING UP, DN. These corrections are good up to 2° out of level condition. Fuel weight based on 6.7 #/gal.

#FUEL	LEVEL	NOSE UP-DN	WING UP-DN
1M & 4M INBOARD STICK			
3000	2.6"	-.2+.2	-.3+.1
4000	4.6	-.4+.4	0-.2
5000	6.4	-.4+.6	+.2-.3
6000	8.1	-.5+.6	+.5-.5
7000	9.5	-.7+.7	+.6-.7
8000	10.9	-.8+.8	+1.0-.9
9000	12.4	-.8 NS	NS-.9
9500	13.4	-.8 NS	NS-.9
10000	NS	NS NS	NS NS
11000	NS	NS NS	NS NS
11685	NS	NS NS	NS NS
1M & 4M OUTBOARD STICK			
9000	1.0"	+1.7 NS	NS+1.5
9500	1.8	+1.5-1.4	-1.5+1.6
10000	2.6	+1.2-1.2	-1.3+1.2
11000	5.0	+1.2- .9	- .9+ .7
11685	8.0	NS- .6	- .6+ .2
2 & 3M			
6000	NS	NS NS	NS+1.25
7000	2.1"	+.2-.3	NS+1.50
8000	5.3	+.2-.2	-1.5+2.20
9000	8.7	+.15- 0	-.9+1.00
10000	13.0	+.3- 0	-.8+0.4
10579	15.5	0+.2	+.2+0.4
1 & 4R			
700	3.7"	-.2+.3	+.7-.6
1000	5.3	-.3+.3	+.8-.9
1500	7.4	-.3 NS	NS-.5
2000	NS	NS NS	NS NS
3000	NS	NS NS	NS NS
4000	NS	NS NS	NS NS
4140	NS	NS NS	NS NS
2 & 3R			
700	0.6"	+.5-.1	- 0+.3
1000	3.0	+.2- 0	0- 0
1500	5.9	0- 0	+.3-.2
2000	8.3	0- 0	+.3-.2
3000	12.1	0- 0	+.5-.5
4000	15.5	0- 0	+.6-.6
5000	18.7	0- 0	+.8-.7
6000	21.7	0- 0	+.8-.9
7000	24.5	0- 0	+.7-1.0
8000	NS	0- 0	NS-1.0
9000	NS	0- 0	NS NS
9052	NS	0- 0	NS NS

O. DEFUELING PROCEDURE

The flight crew can coordinate the removal of fuel from the aircraft using this procedure. Defueling configurations can be established by following the schematic printed on the engineer's panel. Fuel service personnel should refer to Chapter 12 of the Convair Maintenance Manual, especially if the remaining individual fuel tank quantities are to be verified by use of the drip sticks.

Connect fuel truck hose to an inboard tank fueling adapter. A check valve prevents fuel flow from the aircraft unless this is done.

Open the defuel valve for the wing to which the fuel truck hose is connected. The red guarded defuel valve switches are on the engineer's panel. The red "Valve Open" light illuminates only when the defuel valve is in the full open position. The defuel valves use Essential DC power to operate; all other fuel valves use Emergency DC.

Open the crossfeed valve for the affected tank. If it becomes necessary to pump fuel across the fuselage, the emergency crossfeed valve must also be opened.

Turn on the fuel boost pumps in the affected tank. The fuel truck suction pump will be operated to establish a flow rate of approximately 50 gpm for each hose connection.

When the fuel quantity is at the desired level, turn off the boost pumps and fuel truck suction pump, close crossfeed valves, close defuel valves and disconnect fuel truck hose.

* * *

A. CENTER INSTRUMENT PANEL

REVERSE THRUST LIGHT

Indicates that reverser is in the full reverse position.
A3 - THRUST REVERSE WARN.

EPR INDEX KNOB

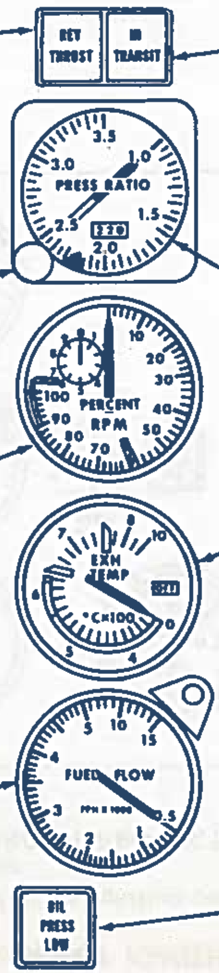
Mechanically controls window setting and sets index at that number on instrument scale.

TACHOMETER

Vernier allows reading to nearest one percent.
NO CIRCUIT PROTECTION.

FUEL FLOW INDICATOR

A8 - FUEL FLOW IND.



THRUST REVERSER IN TRANSIT LIGHT

Indicates that reverser is in some intermediate position.
A3 - THRUST REVERSE WARN.

EPR INDICATOR

A2 - PRESS RATIO IND.

EGT INDICATOR

Shows exhaust gas temperature at turbine outlet in degrees centigrade. The flag indicates power loss to the instrument.
A2 - EXHAUST GAS TEMP IND.

LOW OIL PRESS LIGHT

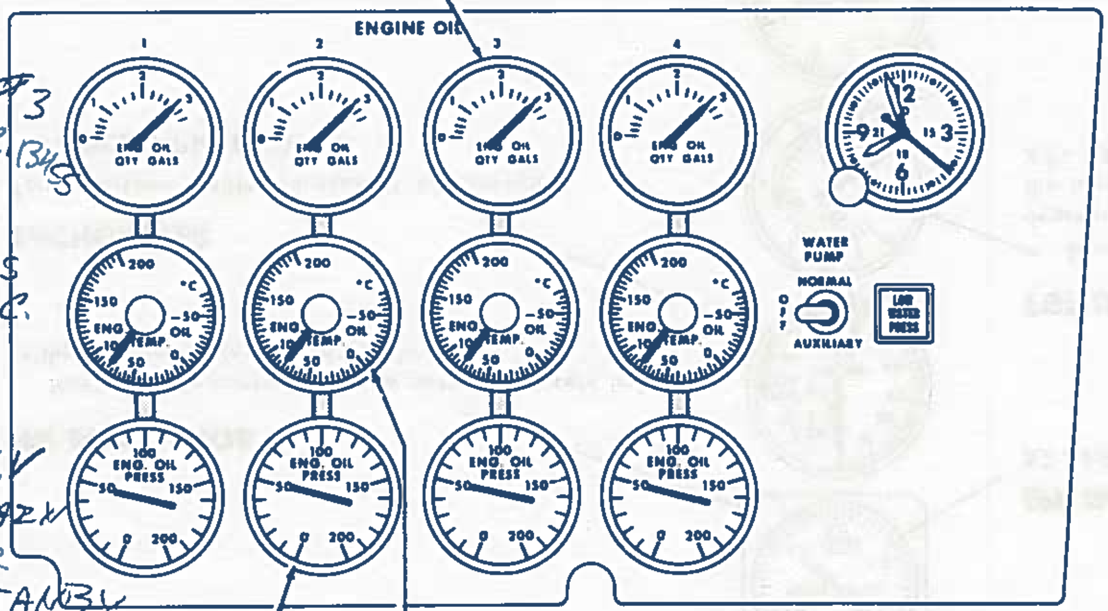
Indicates low engine oil pressure.
B9 - OIL PRESS LOW WARN.

OIL QUANTITY

Shows gallons of oil in tank.
B10 - OIL QTY IND.

EMERGENCY IGNITION POWER ON LIGHT

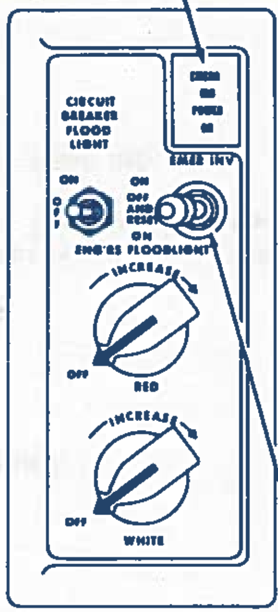
Indicates ignition power available at output tap of static inverter.
NO CIRCUIT PROTECTION.



#3 AC BUS

ESS D.C.

26V HAZN OR STANBY



STATIC INVERTER CONTROL SWITCH

ON (UP) Positive contact position turns static inverter ON.

OFF & RESET - Turns OFF and/or resets static inverter.

ON (DOWN) - Momentary contact position turns static inverter ON.

Circuit protection consists of a current limiter at emergency bus.
EMER IGN STATIC INV.

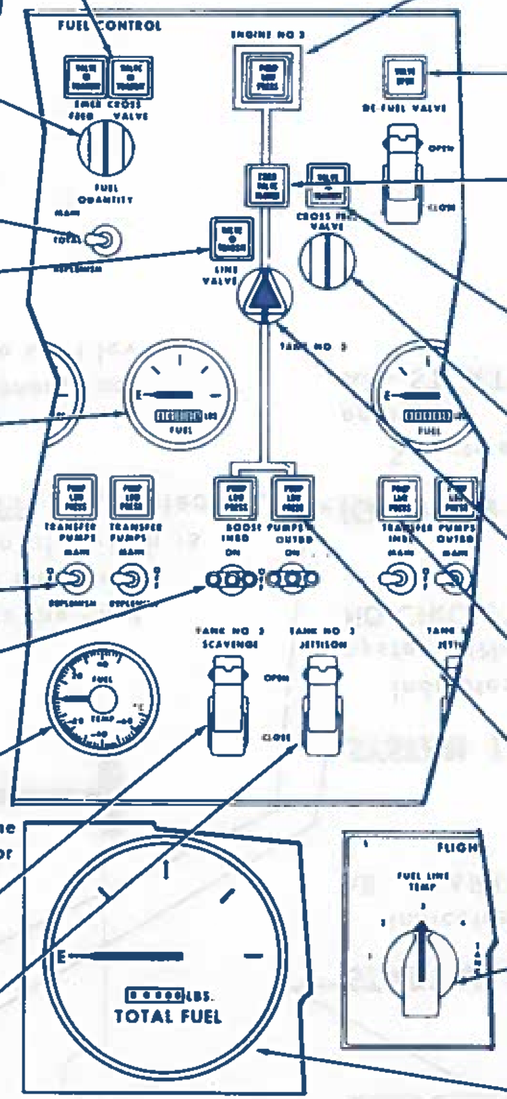
OIL PRESSURE

B10 - OIL PRESS IND.

OIL TEMPERATURE

Indicates scavenge oil temperature.
B10 - ENG OIL TEMP IND.

C. FUEL SYSTEM CONTROL PANEL



EMERGENCY CROSS FEED VALVE IN TRANSIT LIGHTS
SEE NOTE (1)
A7 - FUEL EMER CROSS FEED VALVE

EMERGENCY CROSSFEED VALVES SWITCH
Operates both emergency crossfeed valves.
A7 - FUEL EMER CROSSFEED VALVE.

FUEL QUANTITY SELECTOR SWITCH
Determines which tank section(s) the fuel quantity gouges will monitor.
A5 - REFUEL CONT.

LINE VALVE IN-TRANSIT LIGHT
SEE NOTE (1)
A6 - FUEL LINE VALVE.

TANK FUEL QUANTITY GUAGE
Indicates fuel weight remaining in tank section(s) in accordance with fuel quantity selector switch.
A10 - FUEL QTY IND.

TRANSFER PUMP SWITCH
Turns on respective transfer pump and electrically arms its low pressure warning light.
A10 - A11 - FUEL TRANSFER PUMP.

BOOST PUMP SWITCH
Turns on respective boost pump.
A10 - A11 - FUEL BOOSTER PUMP.

FUEL TEMPERATURE GUAGE
Indicates temperature of fuel at any engine or in the No. 1 tank in accordance with fuel temperature selector switch.
A5 - FUEL TEMP IND.

FUEL SCAVENGE PUMP SWITCH
Turns on the scavenge pump in tank.
A7 - SCAVENGE VALVE.

FUEL JETTISON SWITCHES
Turns on the Jettison pump in the respective tank.
A7 - JETTISON VALVE

ENGINE PUMP LOW PRESSURE LIGHT
Indicates loss of fuel pressure from either or both engine pump elements.
A7 - FUEL PUMP WARN.

DEFUEL VALVE OPEN LIGHT
Indicates defuel valve OPEN.
A5 - DEFUEL VALVE.

EMERGENCY VALVE CLOSED LIGHT
Indicates the emergency fuel shutoff valve is CLOSED.
A6 - FUEL EMER SHUTOFF VALVE.

CROSSFEED VALVE IN TRANSIT LIGHT
SEE NOTE (1)
A6 - FUEL CROSSFEED VALVE.

CROSSFEED VALVE CONTROL SWITCH
Operates respective crossfeed valve.
A6 - FUEL CROSSFEED VALVE.

LINE VALVE SWITCH
Operates resprective line valve.
A6 - FUEL LINE VALVE.

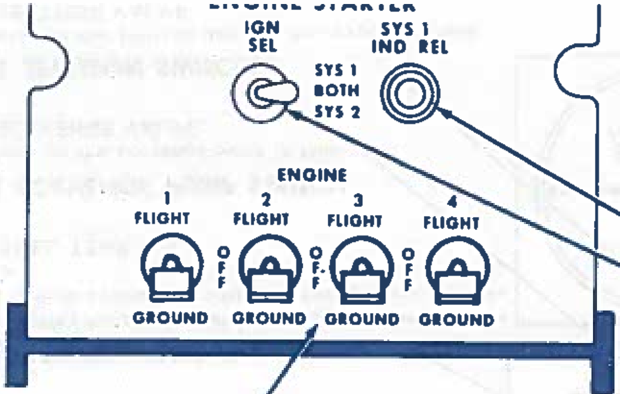
TRANSFER PUMP LOW PRESSURE LIGHTS
Indicates loss of pump output.
A11 - FUEL PUMP WARNING LTS.

BOOST PUMP LOW PRESSURE LIGHTS
Indicates loss of pump output.
A11 - FUEL PUMP WARNING LTS.

FUEL TEMPERATURE SELECTOR
Selects any engine or the fuel tank for the fuel temperature gauge.
A5 - FUEL TEMP IND.

TOTAL FUEL INDICATOR
Indicates total fuel for any fuel quantity selector switch position.
A10 - FUEL QTY IND.

NOTES:
(1) ALL IN-TRANSIT LIGHTS INDICATE VALVE NOT AT EITHER EXTREME POSITION.



START VALVE OPEN LIGHT

Indicates start valve is OPEN.

A8 - START VALVE OPEN WARN.

SYSTEM 1 RELAY INDICATOR LIGHT

Indicates that power is available to the No. 1 ignition system. (No. 3 ENGINE ONLY).

NO CIRCUIT PROTECTION.

IGNITION SELECTOR SWITCH

Selects either or both ignition systems for use on all engines.

A3 - START VALVE ENG. NO. 3.

START SWITCH

GROUND - Completes ignition circuit up to the start lever switch and energises the start valve. Momentary GROUND position of switch is spring-loaded to return to OFF when released.

A4 - IGNITION POWER.

A5 - IGNITION CONTROL.

OFF - Ignition off and start valve de-energized.

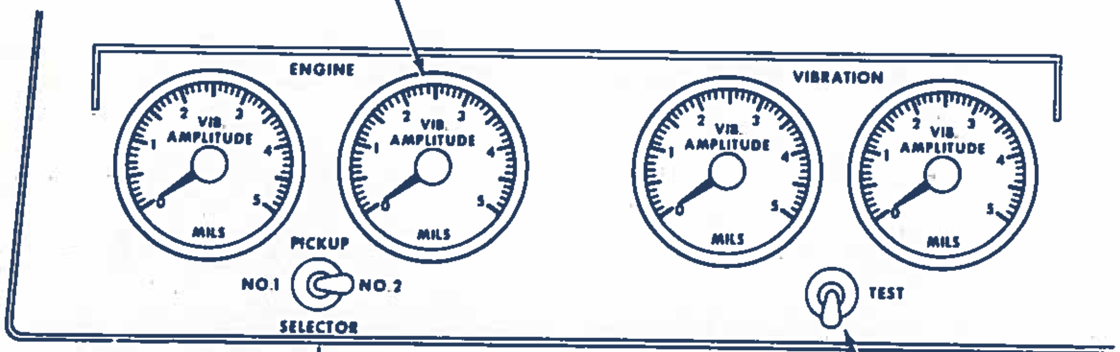
FLIGHT - Completes ignition circuit up to start lever switch.

A5 - IGNITION CONTROL.

E. AVM CONTROL PANEL

ENGINE VIBRATION INDICATOR

Indicates engine vibration amplitude.
C4 - MONITOR.



PICK UP SELECTOR SWITCH

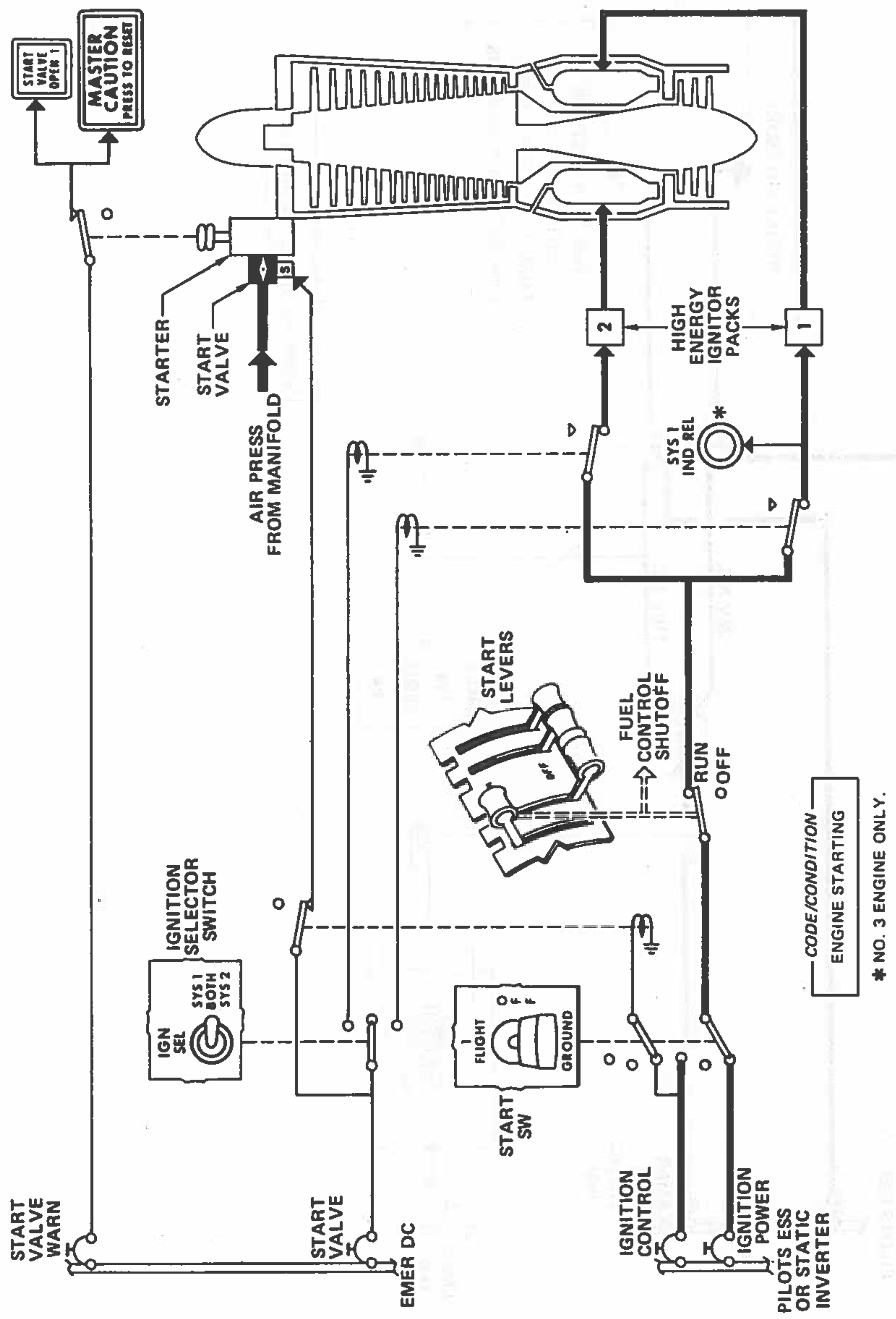
Selects either the No. 1 pick up on the compressor front frame or the No. 2 pick up on the diffuser to be monitored. The selector relay is de-energized with the switch in the No. 2 position.
C4 - PICK UP SELECTOR.

AMPLIFIER TEST SWITCH

Sends a fixed electrical signal to each amplifier which will cause the indicators to read between 3.5 and 4.2 mils.
C4 - MONITOR.

(4108) * * *

ENGINE IGNITION CIRCUIT



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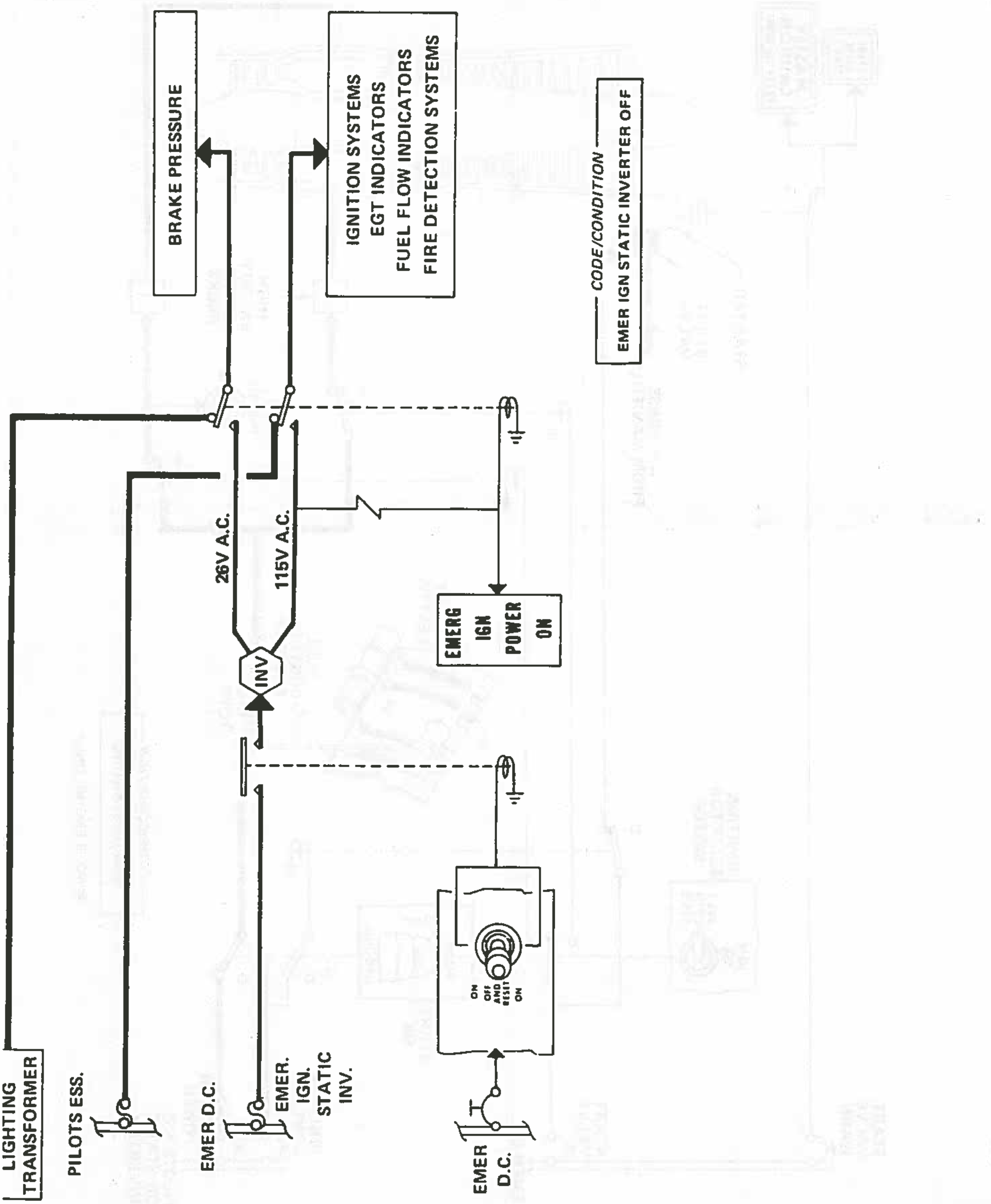
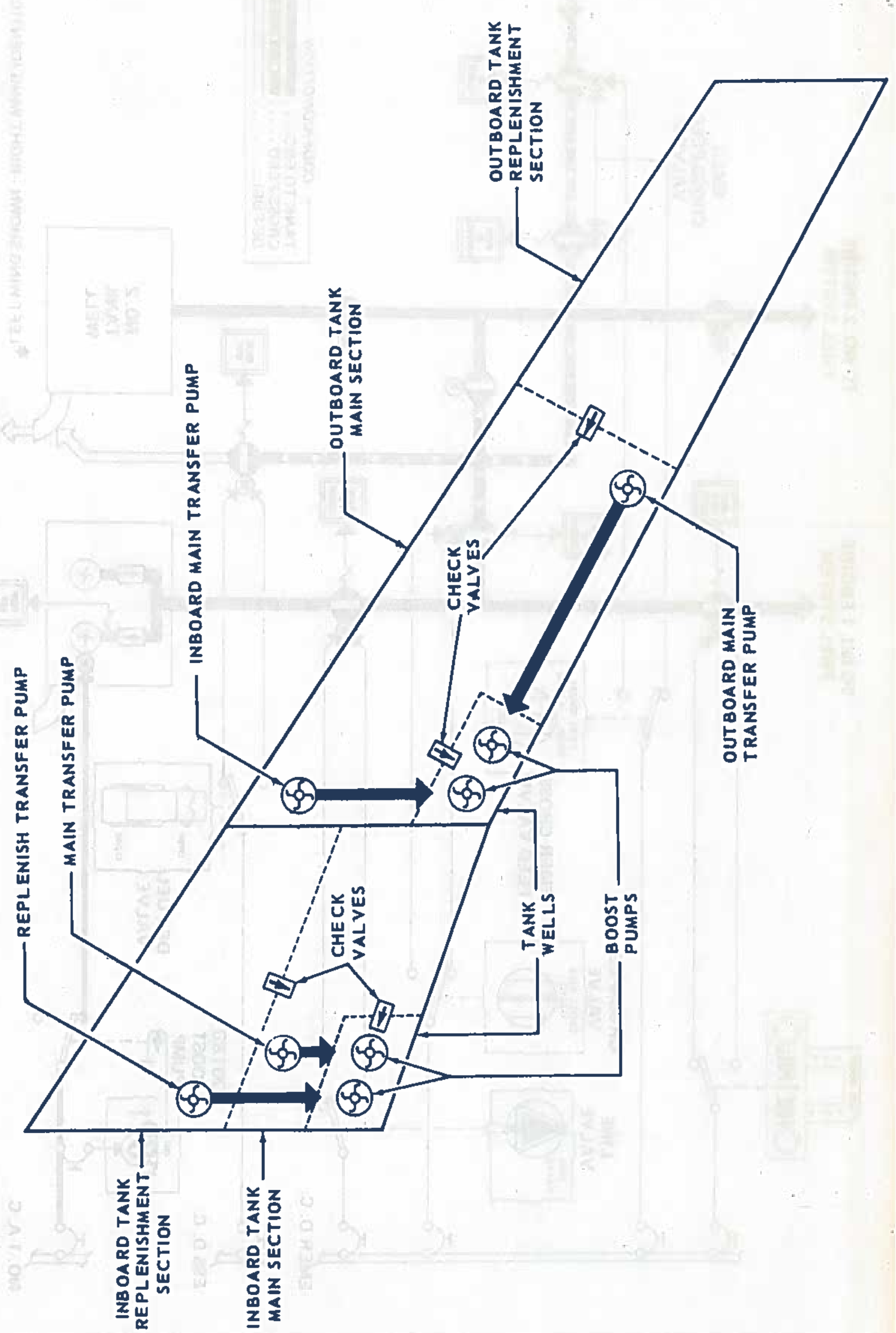
:MERGENCY IGNITION STATIC INVERTER



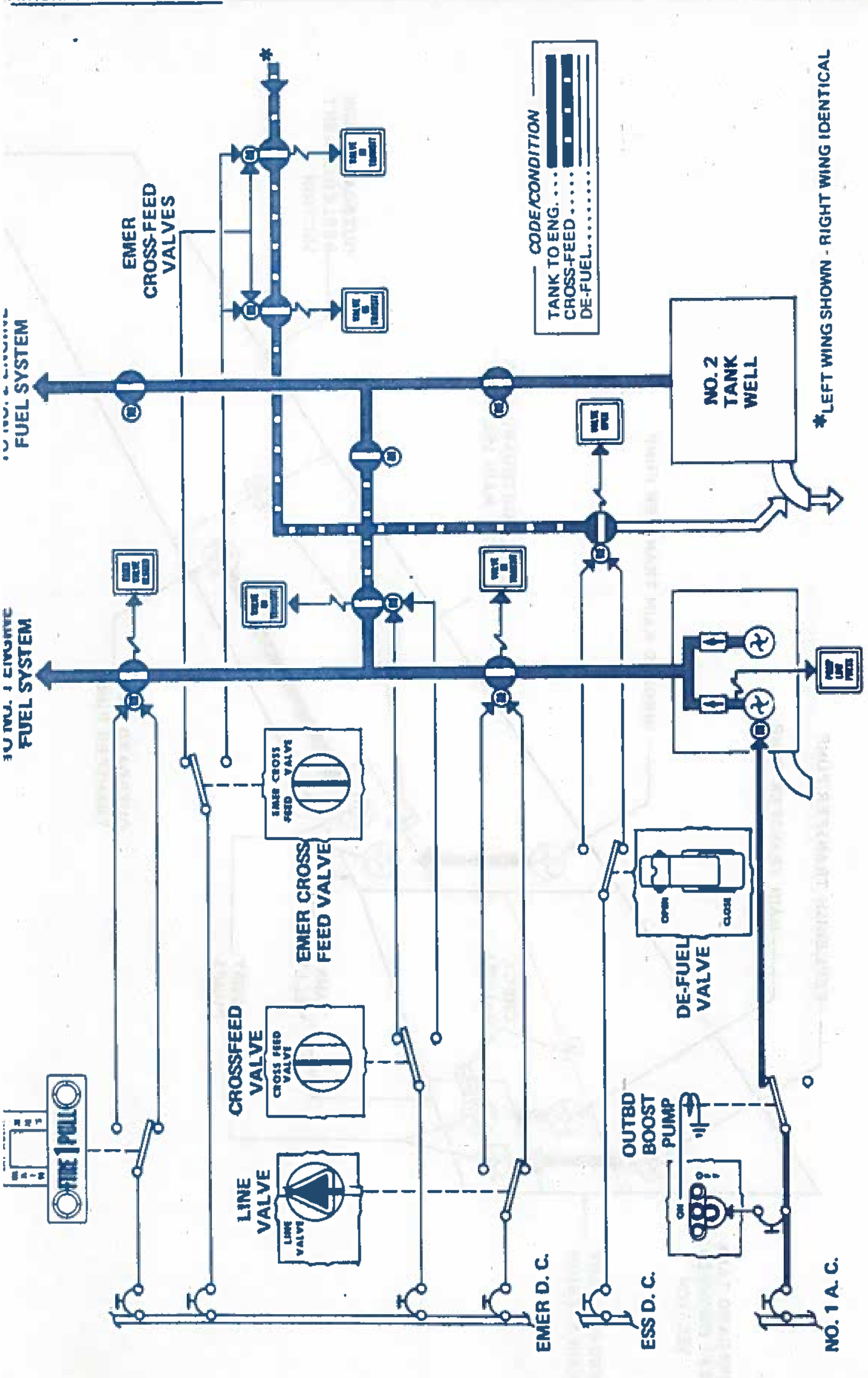
(4161)

C. FUEL TANK



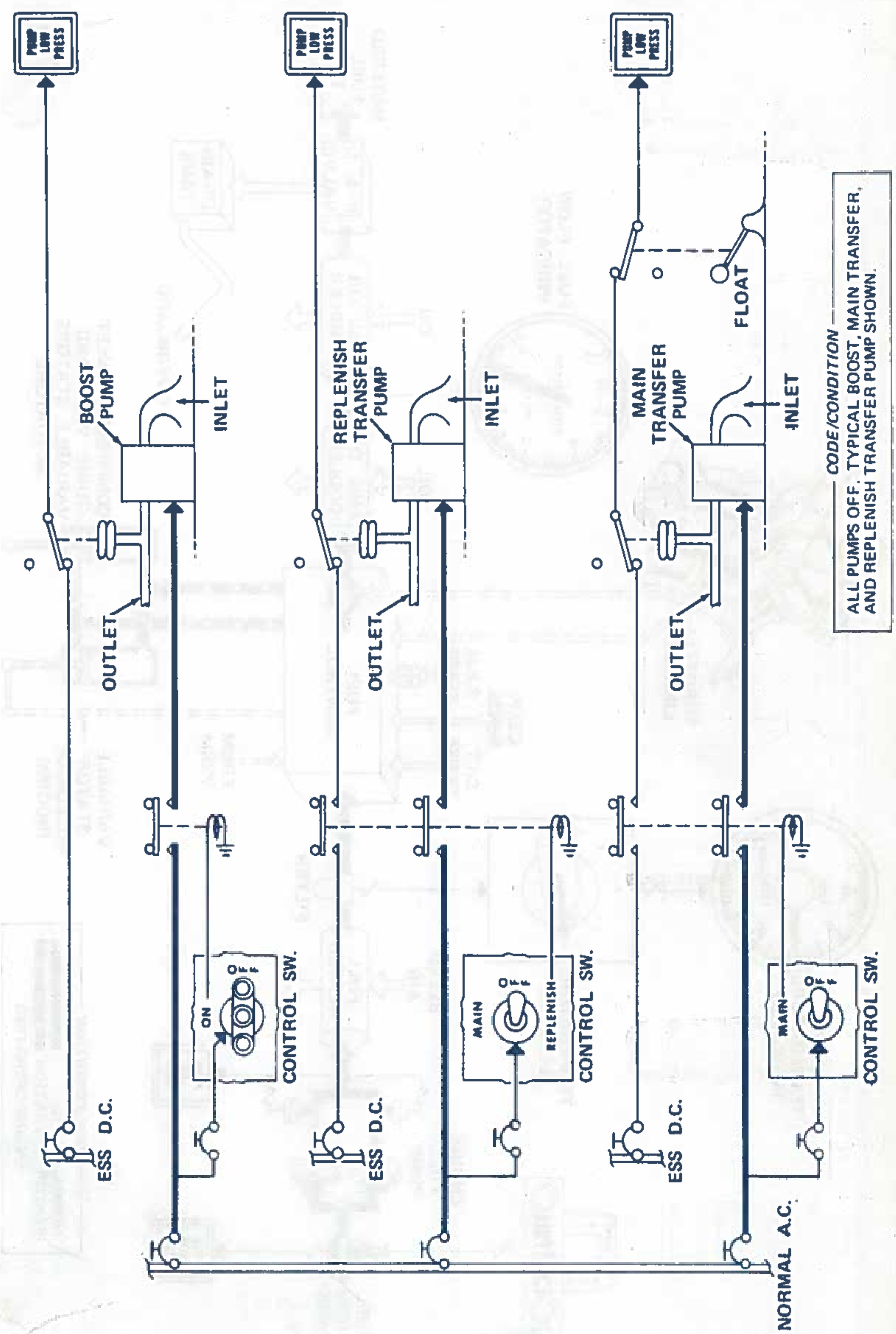
(4112)

AIRCRAFT FUEL SYSTEM



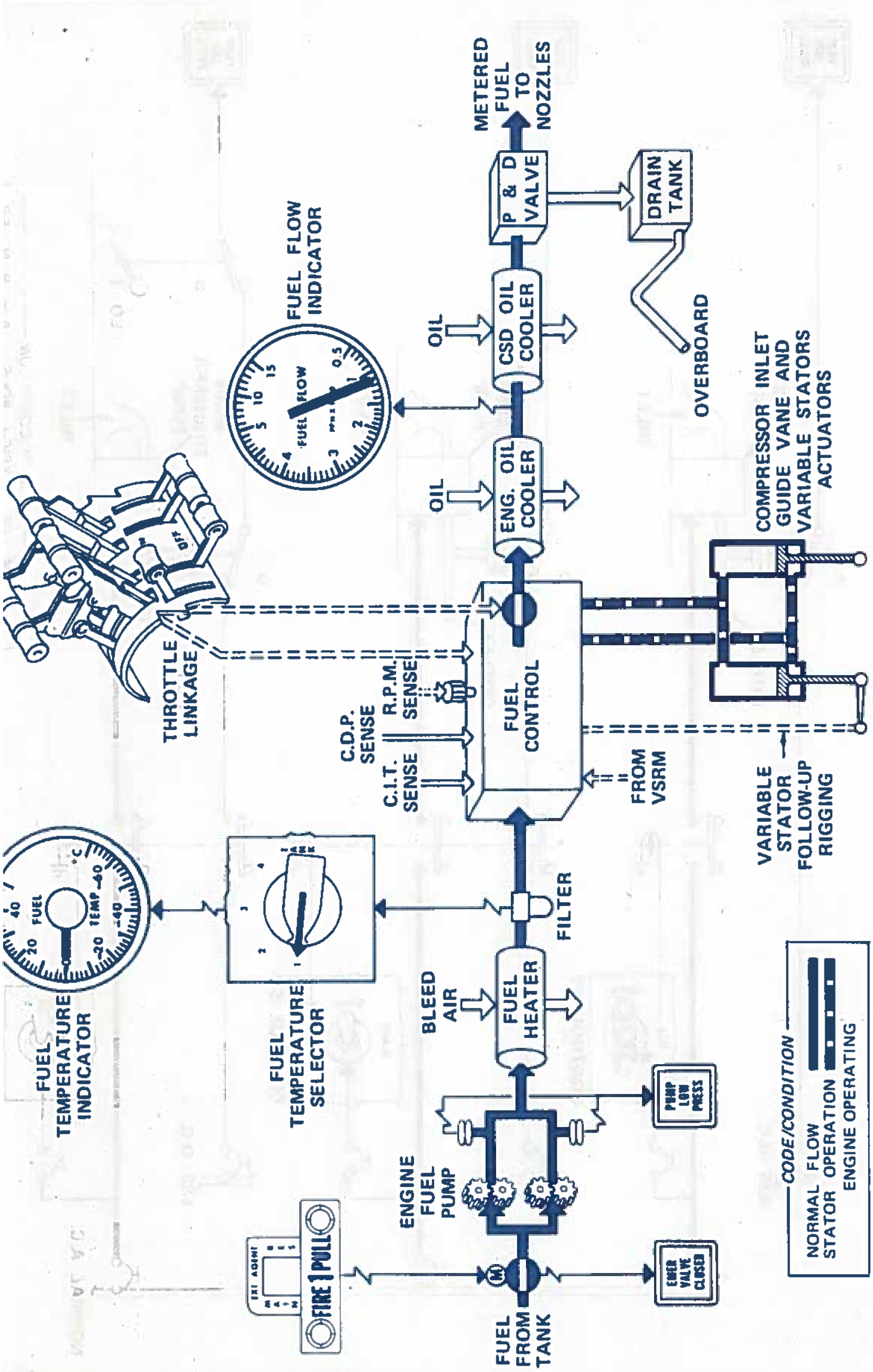
(5265)

E. BOOST PUMP AND WARNING LIGHT CIRCUIT



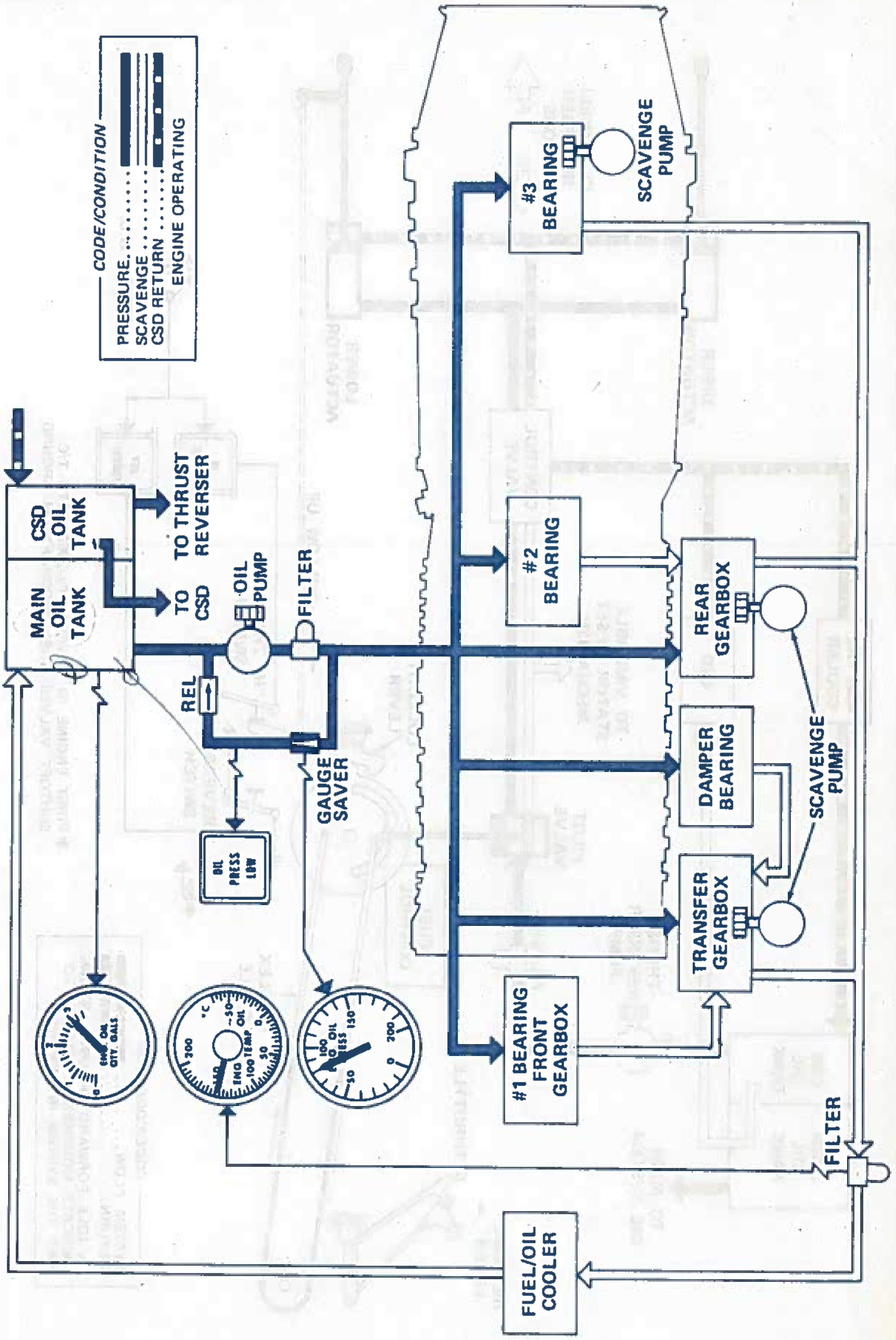
(5266)

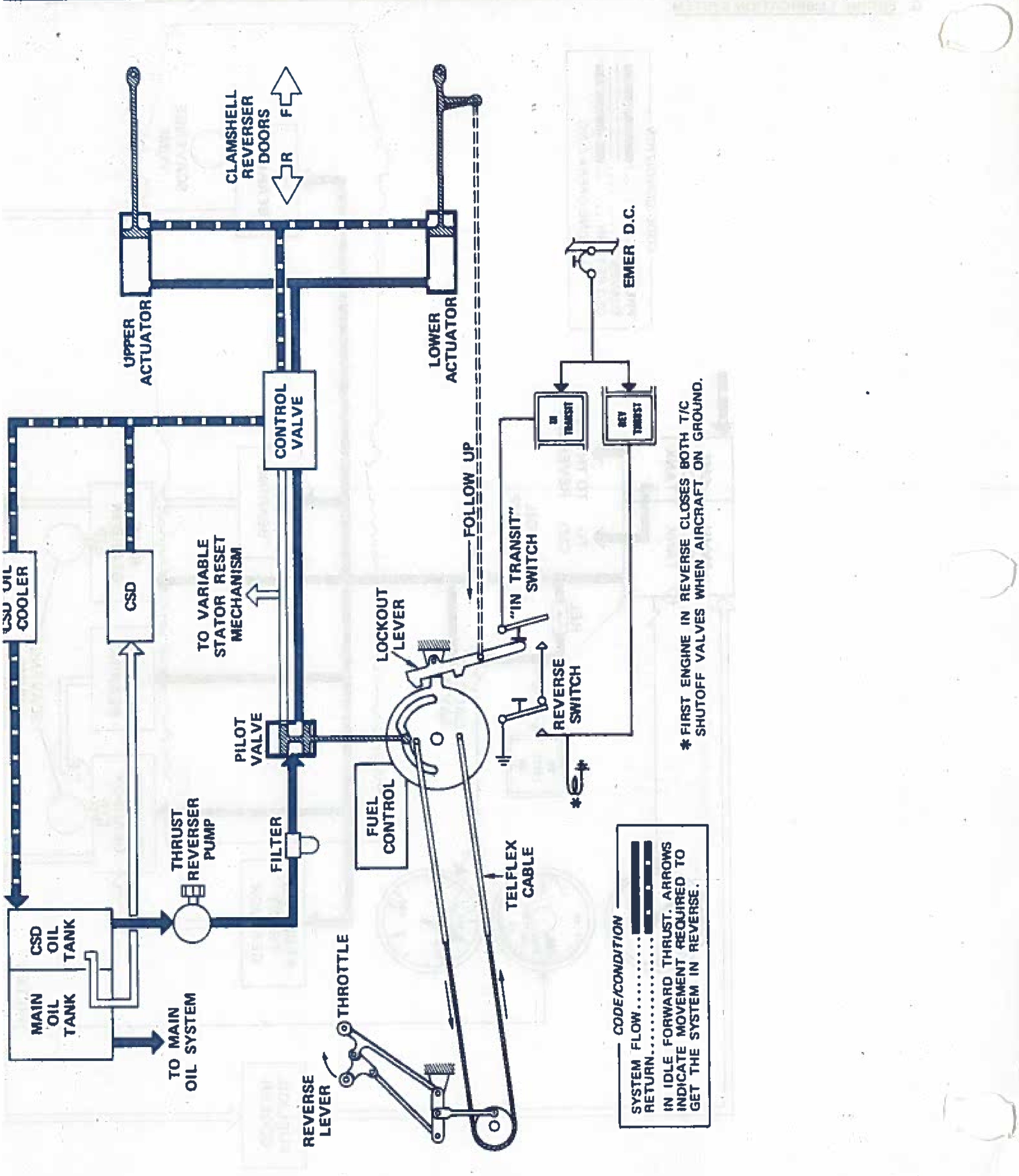
ENGINE FUEL SYSTEM



(5267)

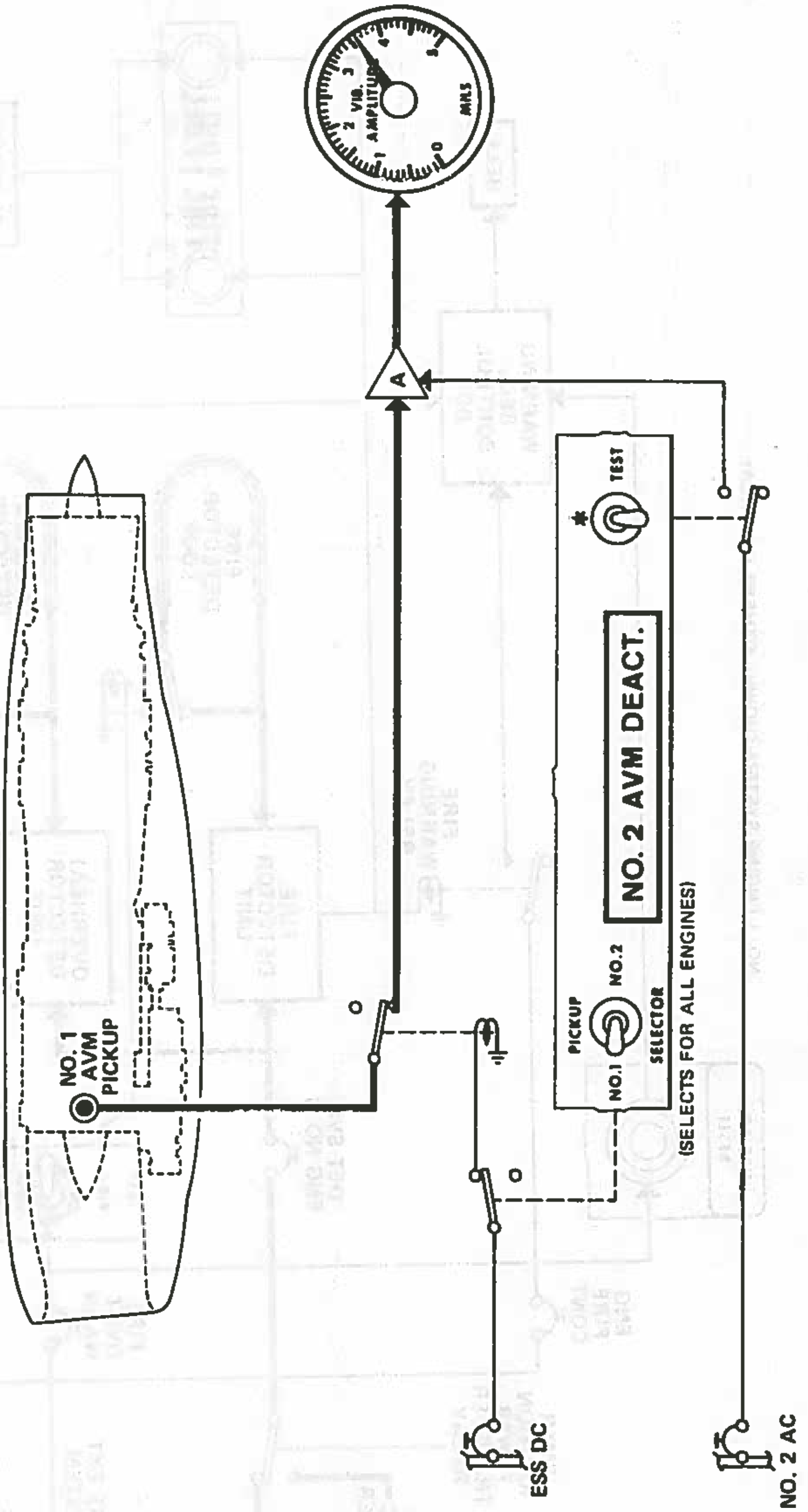
G. ENGINE LUBRICATION SYSTEM




CLAMSHELL REVERSER DOORS
R
F
UPPER ACTUATOR
LOWER ACTUATOR
CONTROL VALVE
FOLLOW UP
EMER D.C.
IN TRANSIT
REV THRUST
"IN TRANSIT" SWITCH
REVERSE SWITCH
LOCKOUT LEVER
CSD OIL COOLER
CSD
TO VARIABLE STATOR RESET MECHANISM
PILOT VALVE
FUEL CONTROL
FILTER
THRUST REVERSER PUMP
TELFLEX CABLE
CSD OIL TANK
MAIN OIL TANK
TO MAIN OIL SYSTEM
THROTTLE
REVERSE LEVER
* FIRST ENGINE IN REVERSE CLOSES BOTH T/C SHUTOFF VALVES WHEN AIRCRAFT ON GROUND.
CODE/CONDITION
SYSTEM FLOW..........
RETURN..........
IN IDLE FORWARD THRUST, ARROWS INDICATE MOVEMENT REQUIRED TO GET THE SYSTEM IN REVERSE.

(3918)

I. AIRBORNE VIBRATION MONITOR

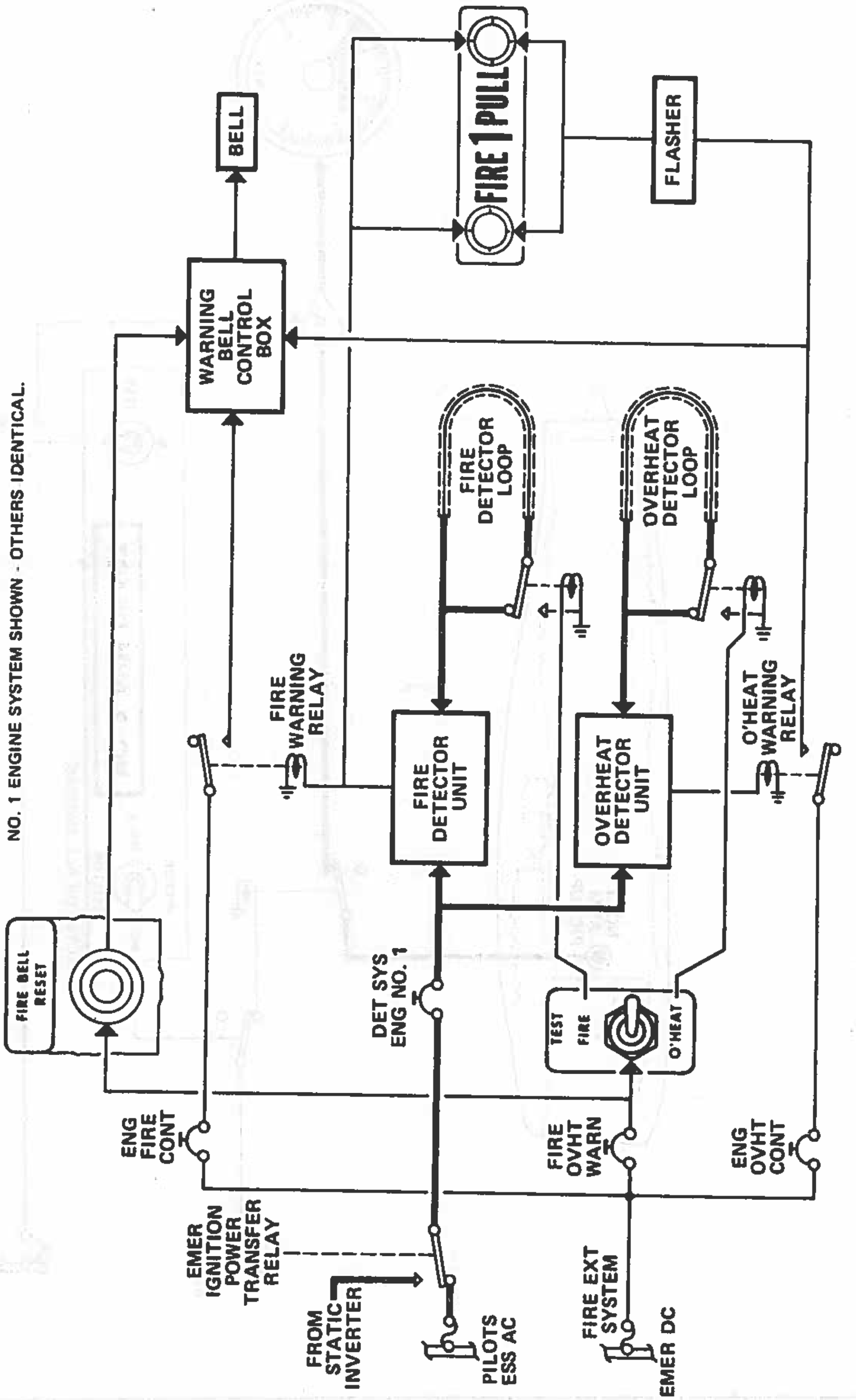


* SENDS A FIXED SIGNAL TO EACH AMPLIFIER. INDICATORS SHOULD INDICATE BETWEEN 3.5 & 4.2 MILS. TESTS CONTINUITY OF SYSTEM, BUT DOES NOT OPERATIONALLY CHECK PICKUPS.

(5263)

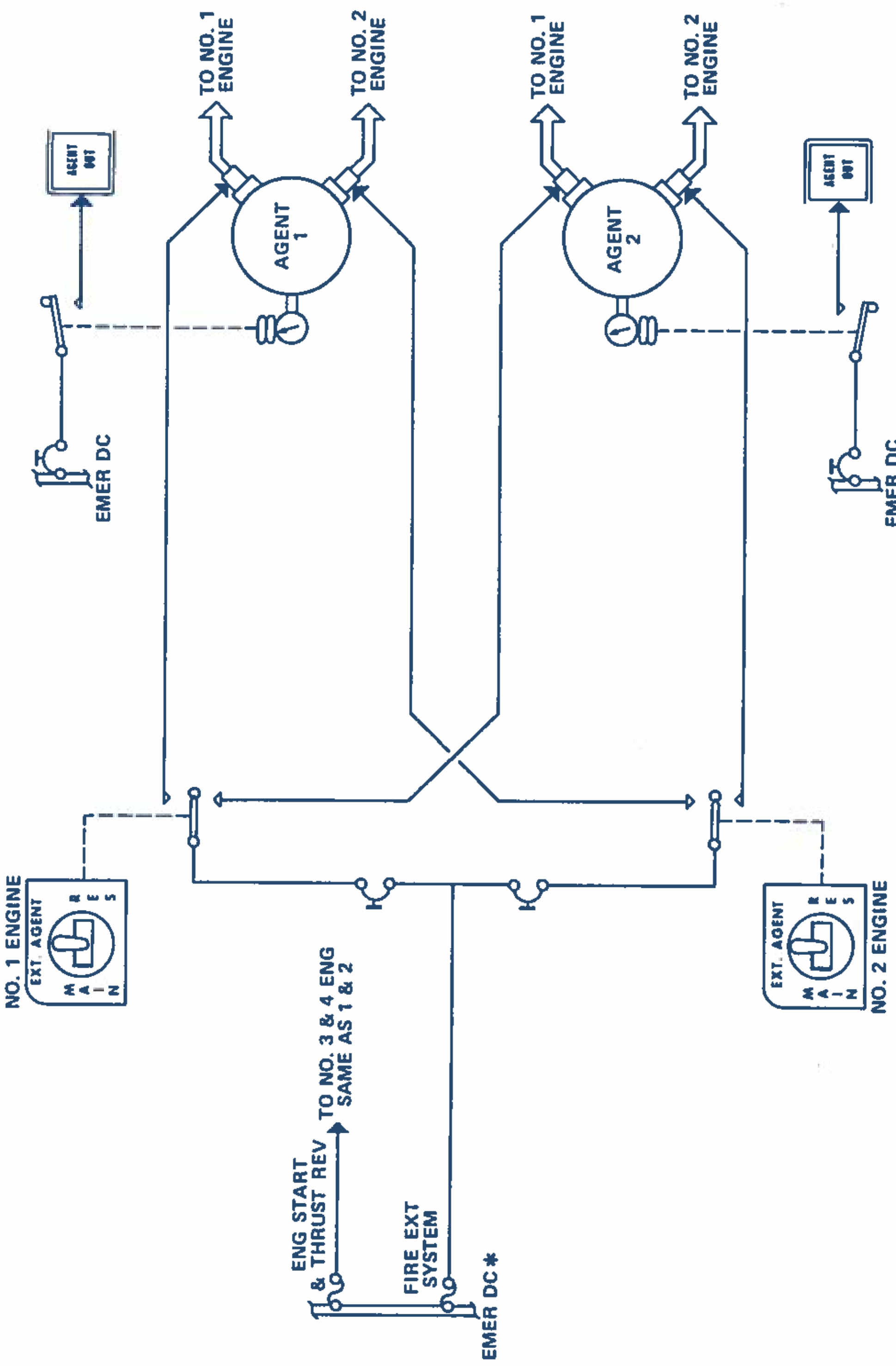
RE & OVERHEAT WARNING

NO. 1 ENGINE SYSTEM SHOWN - OTHERS IDENTICAL.



(5455)

K. FIRE EXTINGUISHING CONTROL



*IF EMERGENCY DC FAILS, FIRE PROTECTION IS TRANSFERRED TO BATTERY BUS.

A. **ENGINE LUBRICATING SYSTEM OPERATION**

The oil quantity should register 3 gallons when the tank is properly serviced. There is approximately one gallon at the bottom of the tank that will not show on the gauge.

A relief valve in the pressure transmitter line will relieve the extremely high pressure which accompanies cold weather starting. This is a gauge protection feature and is not a system pressure regulating device.

Engine main bearings and gear boxes are lubricated by a system of fixed opening spray jets.

B. **FUEL TANK CONFIGURATION**

Each tank is divided into two sections by a wall. This wall serves to prevent excessive surging of fuel inside the tank. The MAIN section of each tank contains the two boost pumps. Each of these pumps is mounted at a tank outlet. The REPLENISHMENT section makes up the remainder of the tank.

Two transfer pumps are contained in each tank for the purpose of pumping fuel from the remote areas of the tank to the tank well. The tank well is a box like structure built around the boost pumps and serves to contain a positive supply of fuel - even at very low fuel levels - for their operation.

A system of check valves serves to direct fuel from the replenishment section through the wall and into the main section. Reverse flow is prevented.

Another set of check valves allows fuel to pass into the tank well but not out.

The tank well is open at the top to allow fuel to spill over into the main tank section with the transfer pumps in operation.

Provision is made to allow fuel to flow back into the replenishment section should the replenishment transfer pumps be operated with the main tank section full. This is accomplished by the use of an overflow vent tube between the tank sections.

The tanks in the right wing are vented to a vent scoop on the under side of the right wing tip. The left wing tanks are vented through an identical system in that wing.

A system of drip sticks may be used as an alternate method of gauging fuel quantity should the electric gauges become inoperative.

C. **ENGINE FUEL SYSTEM OPERATION**

Operation of the fire control handle will close the emergency fuel shutoff valve. This valve is located in the pylon for the purpose of isolating the engine from the rest of the fuel system.

The fuel heater uses engine bleed air to keep the temperature of the fuel above the freezing point of water. The purpose of the fuel heater is to prevent formation of ice crystals which could interfere with the proper operation of the fuel control.

The fuel control consists essentially of two sections, a metering valve and a computer. The computer senses what fuel flow is required by the engine and positions the metering valve accordingly. The fuel control will perform the following functions:

Establish the RPM being called for by throttle position.

Limit engine acceleration fuel flow so as to prevent damaging internal engine temperature.

Maintain sufficient fuel flow during engine deceleration to prevent flame-out.

Position the variable stator assembly to allow stall free operation over the normal RPM and temperature ranges.

Fuel is passed through the core of the engine oil and CSD oil coolers to act as the cooling agent. These coolers function automatically.

The fuel flow transmitter depends on a small internal electric motor for its operation. To prolong the service life of these units it is recommended practice to pull the FUEL FLOW IND circuit breakers if electric power is applied to the airplane for extended periods of time without the engines operating.

D. **OPERATION OF REFUELING EQUIPMENT**

Any tank may be fueled by either the underwing (pressure) provision or the overwing (gravity) provision.

Each tank has a separate underwing fueling port. Attachment of a fueling hose will mechanically force a check valve in the inlet of the port open. This valve prevents fuel from leaving the tank through the fueling port when a fueling hose is not connected.

Pressure developed by the refueling truck will force both the primary and the secondary fueling valves to open. This allows fuel to flow into the main section of the tank. Only when the main section is full will fuel flow through the vent tube into the replenishment section.

When the fuel level reaches the refuel pilot valves located at the FULL level in the tank, one of the fueling valves - either the primary or secondary - will close and stop the fuel. Which fueling valve that closes depends upon which refuel pilot valve happens to be actuated by the rising fuel. Two fueling valves are provided in the fueling line so that each may serve as a back-up for the other.

The refuel pilot valves may be tested to determine that they will close the fueling valves. The REFUEL SHUTOFF TEST SWITCH will send a "full" signal to whatever fueling valve (primary or secondary) is selected. That valve should close and stop the flow of fuel. This is the only feature of the fueling system that requires electrical power.

Overwing fueling ports are located over the respective replenishment sections.

FUEL JETTISON - SCAVENGE

General

A fuel jettison system is provided for emergency weight reduction. The system consists of six hydraulically operated pumps in the wing tanks which discharge through fixed jettison nozzles in the wing trailing edge near the wing tip. Four of the pumps are called jettison pumps and are fitted with standpipes which retain a pre-determined level of fuel in each tank. The other two pumps are called "scavenge" pumps, they are located in the inboard tank wells, and are capable of completely emptying the inboard fuel tanks if required for gear up landing, ditching, or other reasons. Each jettison pump is connected to its respective jettison nozzle and will jettison fuel at the rate of approximately 805 Lbs/ Min/ Tank.

The jettison and scavenge pumps are electrically controlled by solenoid actuated hydraulic shutoff valves. Control switches are located at the bottom of the engineer's lower instrument panel.

Fuel Jettison Pumps

The fuel jettison pumps are hydraulically driven, centrifugal pumps located on the rear wing spar. There are four jettison pumps and two scavenge pumps. The source of pressure for the jettison pumps is the No. 1 hydraulic system. The scavenge pumps are powered from the No. 2 hydraulic system. The pumps themselves are mounted in receptacles which extend through the spar, so the pump is submerged in the fuel tank, but the motor is outside the tank.

Solenoid operated hydraulic valves located on the rear wing beam are used to control the pumps. Energizing the valve solenoid will open it and port the hydraulic fluid to the pump motor. Any interruption of electrical power to the valve will cause it to close.

The source of power used to open the jettison pump control valves is emergency 28V DC. The control circuit breakers are on panel A in the cockpit. The pump control switches are located on the bottom edge of the fuel control panel (engineer's station) in the cockpit. The switches are guarded to the OFF position.

Fuel Jettison Shutoff Valves

The jettison shutoff valves are pressure operated valves located directly forward of the jettison nozzle. They are spring-loaded closed to prevent syphoning of fuel during normal flight operations and to act as flame arrestors. The jettison fuel pressure necessary to open these valves is approximately 8 PSI.

Fuel Jettison Nozzles

The fuel jettison nozzles are fixed, tubular nozzles in the wing trailing edge approximately 10 feet inboard of the wing tip. Each nozzle assembly is two separate tubes, welded together with the inboard tube serving the outboard tank. The nozzle and its shutoff valve cause the jettison fuel flow to discharge at a velocity high enough to prevent reverse flow in the wing boundary layer.

The remote location of the nozzle, near the wing tip trailing edge, eliminates the possibility of fuel impinging the structure of the airplane in any configuration of landing gear or flap extension.

Fuel Jettison Controls

The fuel jettison and scavenge pumps are controlled by switches on the engineer's lower instrument panel. These are guarded switches which are held in the OFF position by the guards.

The power source for these switches is the EMER. DC bus. A single 20 AMP current limiter placarded FUEL CONTROL on the EMER. 28V DC bus supplies power to the four 2 AMP circuit breakers on panel A placarded JETTISON VALVE, ENG. 1, ENG. 2, etc. These circuit breakers in turn supply power to the fuel jettison pump control switches. A single 15 AMP current limiter on the EMER. 28V DC bus, placarded ENG. START AND REV. THRUST supplies power to two 2 AMP circuit breakers on panel A placarded SCAVENGE VALVE - TANK NO. 2, TANK NO. 3. These circuit breakers in turn supply power to the control switches. Placing a jettison or scavenge pump control switch to the OPEN position puts power on the solenoid operated hydraulic shutoff valve. If hydraulic pressure is available in the system, the selected pump will operate.

F. STATIC INVERTER OPERATION

The static inverter control switch has two ON positions. One is a positive contact position and the other is momentary contact.

The static inverter will generate enough heat to burn out if it is operated beyond the prescribed time limit. A one hour cooling period is required for each 12 minutes continuous use.

Electrical overload protection is provided in the form of a trip circuit. The EMER IGN POWER ON light will go out in the case of a trip. A reset may be affected by moving the control switch to the OFF AND RESET position and back to ON if further use is required.

G. THRUST REVERSER OPERATION

The quadrant is designed to allow the reverse lever to be moved only when the main power lever is at the idle position.

Both the main power lever and the reverse power lever cause rotation of the sheave on the fuel control. The sheave is attached to the throttle shaft in the fuel control. Rotation of the sheave in either direction from idle will cause the engine to accelerate.

The main power lever will cause the sheave to turn in one direction and accelerate the engine in forward thrust.

G. **THRUST REVERSER OPERATION (CONT'D.)**

The reverse lever will rotate the sheave in the opposite direction. This action will cause the cam in the sheave to shift the pilot valve and start the reverser moving to the reverse position.

The lockout lever will prevent the pilot from applying reverse power until the reverser has reached the full reverse position. As long as the lockout lever prevents application of reverse power, the reverse lever is said to be "locked out.

The "lockout" will be removed only when the reverser gets to the full reverse position.

Note that this "lockout" is dependent only on reverser position.

Both the IN TRANSIT and the REV THRUST lights serve to verify what the pilot is already able to determine by feeling the "lockout." The reverser is in some intermediate position if the "lockout" is present. The reverser is in the full reverse position if the "lockout" is gone.

The pilot should rely on the reverse throttle "lockout" as the primary means of determining reverser position.

The reverser is designed to stay in position in the event of a system failure.

Selecting reverse will direct hydraulic pressure from the reverser system to the "variable stator reset mechanism" on the fuel control. This causes the follow-up from the stators to shift slightly to the open position. The fuel control will close the stators slightly to correct this condition. This will provide the required stall margin while in reverse.

H. **OVERHEAT AND FIRE DETECTOR SYSTEM**

The fire and overheat detector system for the engine nacelles and pylons is an AC powered continuous loop system which provides visual and aural warnings to the cockpit. The fire warning signal is the steady illumination of the lights in the fire control handle and ringing of the warning bell. The overheat warning signal is flashing lights in the fire control handle, and steady ringing of the bell.

The fire detector system detects excessive temperature levels in the section of the engine nacelle forward of the engine fire seal. The overheat detector system detects excessive temperature levels in the engine nacelle aft of the fire seal.

The fire and overheat detection circuits are 115V AC single loop type.

All fire controls are on the panel on the center of the glare shield. All system components except the detector cables are mounted in the nose of the aircraft on the right side of the nose wheel well.

Electrical power for the operation of the detector units normally comes from the pilots essential AC bus. In emergency conditions, it can be supplied by the Emergency Static Inverter.

Emergency DC bus power is used to operate the alarm bell and to operate the warning light for overheat warnings only.

Detector Cable Loops

The fire and overheat detector cables are small diameter tubing which encloses a single wire conductor which is insulated from the tubing by a eutechtic salt. At low temperatures the salt material offers high resistance to electric current. When the alarm temperature is reached, the resistance drops rapidly and provides ground potential to the control coil of the detector unit. The alarm temperature of the fire detector loop is approximately 300° C. The alarm temperature of the overheat detector loop is approximately 400° C.

Detector Units

The fire and overheat detector units are magnetic amplifier units which supply the power required to operate the alarm signals.

Test Relays

The fire and overheat test relays are energized whenever the test switch on the glare shield (right side) is placed to the respective test position. When energized, the relays supply a ground in series with the detector cable loop, which simulates a fire or overheat condition, and checks the electrical continuity of that loop.

Warning Control Box

The warning control box on the right side of the nose wheel well contains one primary circuit and eight transistor circuits which act as remote switches which activate the alarm bell when a fire or overheat warning is received. They also will act as cutoff relays when the BELL RESET switch is depressed. This will interrupt power to the alarm bell as long as the alarm signal is present. The units are self resetting when the alarm relay is de-energized.

Power Relay Package

The power relay package has eight dual contact relays. The winding of these relays are connected in series with the respective fire or overheat detector POWER winding. When the fire or overheat condition causes the POWER coil's impedance to drop, current flows through the power coil and the signal relay. Closing the contacts of the signal relay supplies power to the warning lights and to the warning control box to activate the bell. The output of the overheat signal relays goes through the respective flasher unit.

Flasher Units

The four flasher units are mounted beside the power relay box on the outboard side of the nose wheel well. Each of the units is connected to one of the overheat signal relays and to the warning lights in the cockpit. When the DC power is supplied to them they cause the lights to flash on and off approximately two times per second.

Warning Lights

Two parallel warning lights are mounted in each of the FIRE PULL handles in the cockpit. To change the light bulbs, unscrew the plastic covers from the handle, the bulb, (No. 327) is pushed into this plastic cover from the rear.

FIXED FIRE EXTINGUISHING SYSTEMS

The fixed fire extinguishing systems provide high rate discharge fire extinguishing protection for the engine pods and pylons only. A single charge of 6.5 lbs. of bromotriflouromethane is contained in a spherical containter located in each engine pylon. The agent may be electrically released to either of the two engines on that side of the aircraft. The extinguisher agent cannot be crossed over from one wing to the other.

The switches which release the fire extinguisher agent are located on the glare shield in the cockpit. An integral guard on the fire control handle conceals them until the respective engine fire control is pulled to the off (aft) position. Electrical power for release of the agent comes from the 28V DC emergency bus, therefore the power necessary for release of the agent can be made available by placing the battery switch to the EMERGENCY position.

Fire Extinguisher Controls

The engine fire controls are tee handles located on the glare shield in the cockpit. An over-center spring detent "loads" the handle in either the normal stowed position against the glare shield or in the active aft position and prevents inadvertent mid-positioning of the control.

Two red lights are mounted in the face of the control handle. These lights will both illuminate when a fire or overheat signal is received.

Pulling the control aft will actuate a set of four microswitches which will perform the following functions:

Close the emergency fuel valve for that engine.

Close the hydraulic pump inlet valve.

Close the engine bleed air valve if not already closed.

Turn off the hydraulic pump low pressure warning light.

In addition to the four electrical functions of the fire control, pulling it out will expose the fire extinguisher discharge switch.

Extinguisher Discharge Switch

The fire extinguisher discharge switch is a three-position, momentary contact switch which is spring-loaded to the center OFF position. In this position it is normally covered by the guard portion of the fire control handle. With the fire control pulled, the switch can be moved to the left to discharge the MAIN extinguisher charge for that engine. Placing the switch to the right will release the RESERVE extinguisher charge for that engine.

Agent Out Lights

The red AGENT OUT lights on the glare shield illuminate to indicate that the pressure in the bottle has dropped below 250 PSI. The switch which controls this light is an integral part of the pressure gauge on the fire extinguisher bottle. When the pressure gauge indicates less than 250 PSI the switch closes and supplies ground potential to the warning light in the cockpit.

Fire Extinguisher Containers

The fire extinguisher containers are spherical bottles which contain approximately 6.5 pounds of the agent. In addition to the agent, the bottle has a propelling charge of dry nitrogen gas which pressurizes the container to approximately 600 PSI. The actual pressure will vary directly with the temperature of the container. The location of the bottle is in the aft end of each engine pylon above the turbine section of the engine. Heat "soak" from the turbines after engine shutdown will cause the pressure to increase considerably above the normal pressure. Each container has two explosive type discharge valves attached to it. A thermal relief plug in the side of the container protects it from over pressure. This plug will release the agent overboard if the temperature of the bottle exceeds 266°F. Thermal release of the container will rupture the red plastic indicator disc on the side of the pylon.

Bottle Pressure Gauge

A direct reading indicator gauge is attached to each container and is visible through a plastic window in the side of the pylon. If a substantially lower or higher pressure is observed in one gauge in comparison with others, request maintenance to investigate. An integral part of the pressure gauge is a microswitch which closes when the gauge pointer is at 250 PSI or below. The switch when closed supplies ground electrical potential to the AGENT OUT indicator lights on the glare shield in the cockpit.

Fire Extinguisher Discharge Valves

The fire extinguishing agent is released by an explosive charge which fires a metal slug through a frangible disc in the wall of the bottle. The discharge valve is the housing which contains the explosive charge and the electrical filament that fires it. These valves (two on each bottle) are attached to the bottle by a large gland nut. With the valve in place the discharge slug is "aimed" correctly to strike the center of the frangible disc. When the disc breaks the propelling charge pushes the agent out of the bottle to the fire location. A screen in the discharge valve assembly stops the pieces of the disc and the metal slug so the agent will not carry metal particles to the discharge manifold. One of the two discharge valves on each bottle is connected to the inboard engine on that wing of the aircraft and the other is connected to the outboard engine. Selection of the correct charge is accomplished by the control switches in the cockpit.

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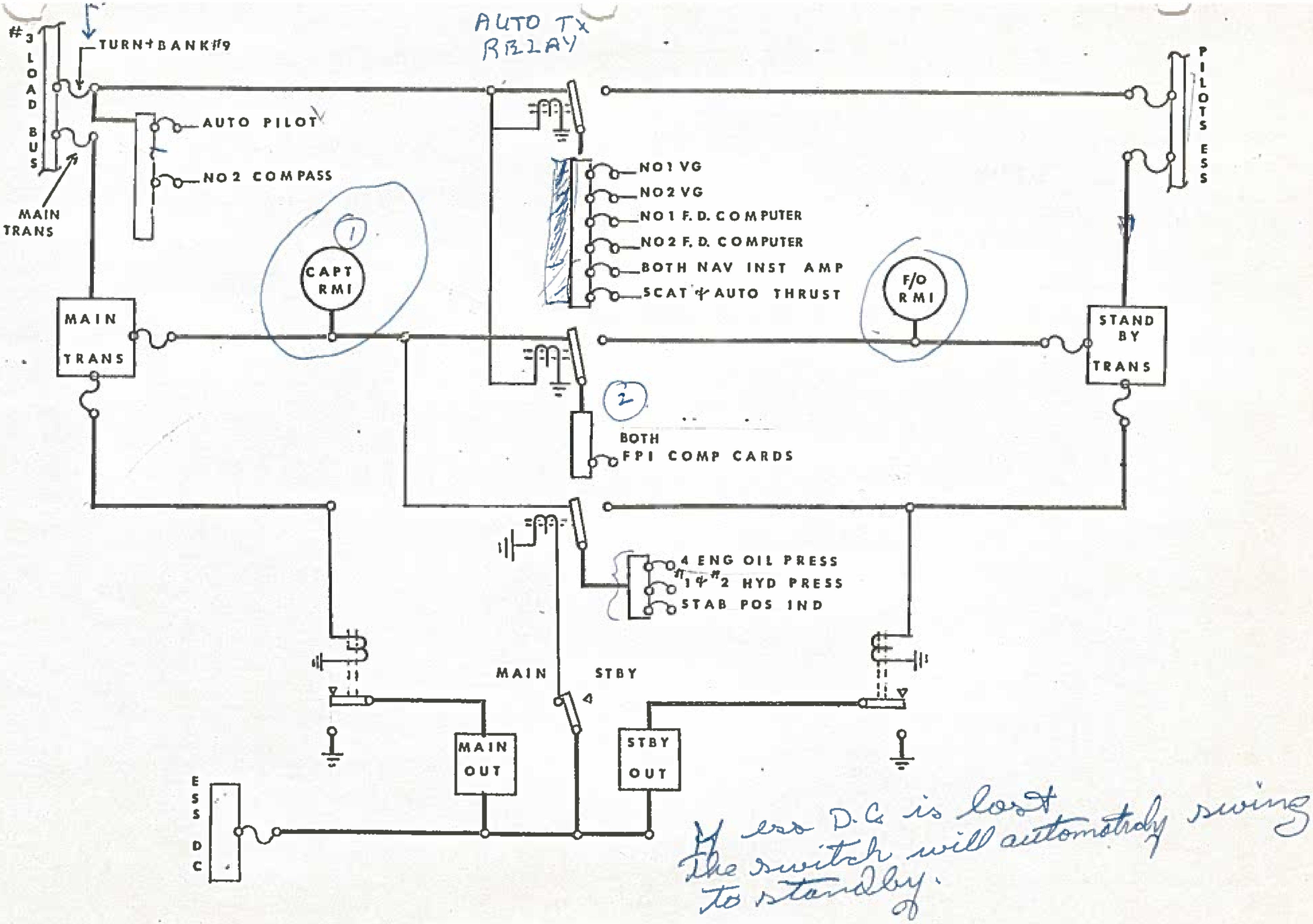


AUTO TRANSFER SYSTEM

AC POWER - GENERAL

If any indicator or warning light illuminates on the electrical control panel proceed as follows:

1. Check that the Pilot's Essential bus is not affected and is still supplied power by the Sync bus. If without power, select any operating generator.

2. Check that all generator load busses have a power source. If any bus without power, close its bus tie relay.

3. Select problem generator system with the Freq/Volt selector.

4. If for some reason the AC power system becomes unparalleled (one or more bus tie relays open) no attempt should be made to reparallel the generator system until the frequency and voltage have returned to normal; i. e., 400 ± 4 CPS and 115 ± 2V.

5. All generator trips should be noted in the log book for maintenance information or corrective action as necessary, even though subsequent closing of the tripped relay results in normal operation.

6. Freon compressors must never be allowed to start from an isolated load bus.

7. If a generator cannot be operated in parallel due to abnormal indications but is able to operate isolated, the following items should be considered:

   If power is needed, operate affected generator with its bus tie open.

   If power is not needed, and the generator is kept as a standby, open the field relay.

   If frequency and voltage monitoring is desired, open the line relay, leave the bus tie relay closed, and close the field relay.

FIELD RELAY INDICATOR LIGHT ....ON

1. Check voltage and frequency.

   a. If frequency high, low or erratic . . . disconnect drive.

   b. If voltage high, low or erratic . . . . . generator may be Operated as a standby.

   c. If frequency and voltage appear normal . . . . . place generator field switch to the ON position, generator field light should go out.

GENERATOR LINE RELAY INDICATOR LIGHT ....ON

(Other generators on Sync bus)

NOTE
As no fault will trip only the line relay, this condition should be experienced only on engine starting.

1. Check that field relay is closed.

2. Check ammeter and power meter readings. If load is indicated, line relay must actually be closed. If no load indicated, generator may be out of parallel limits or autoparallel circuit defective.

   a. Check AC voltage and frequency

      (1) If frequency is high, low or erratic, disconnect drive.
      (2) If voltage and frequency normal, open the bus tie relay. If line relay now closes, autoparallel circuit is defective. Parallel operation can be obtained by the following:

         (a) Open all remaining bus ties.
         (b) Reclose bus ties starting with defective system, allowing it to go on sync bus first using its priority relay.

BUS TIE RELAY INDICATOR LIGHT ....ON

1. If the generator field and generator line relay lights are also on . . close bus tie relay. (Cycle bus tie switch open and close).

2. If only the bus tie relay light on . . monitor associated generator frequency and voltage.

   a. If voltage and frequency normal . . close bus tie relay.

      (1) If light goes out and comes back on . . reclose bus tie relay and open generator line relay, or operate generator isolated with bus tie open if its power is needed.

   b. If frequency is high, low, or erratic. . open line relay, close bus tie relay and disconnect CSD.

   c. If voltage high, low, or erratic . . generator may be operated as a standby.

   d. If bus tie relay will not close (the light will not go out).

      (1) An AC Power Control circuit breaker on B panel may be tripped.

      (2) If other generator (s) are on Sync bus . . may be out of parallel limits, or defective autoparallel relay or circuit.

      Open all other bus ties and reclose, starting with the defective system. This bypasses the defective autoparallel circuit using the priority relay system.

      (3) If all bus ties remain open when paralleling is attempted, the priority relay for the operating generator to the left may be defective. Cycle its bus tie switch open (allowing another generator to be first on the Sync bus) and reclose allowing it to autoparallel.

GEN PMG/EXC VOLTAGE CHECK

The generator PMG/EXC voltage should be checked whenever generator indications are not normal. When the generator field switch is off, permanent magnet generator voltage is indicated. PMG voltage will vary directly with generator RPM. When the generator field switch is on or in test, generator field voltage will be indicated. Field voltage will vary with generator load requirement.

GEN PMG/EXC VOLTAGE CHECK (Cont'd)

To check PMG/EXC voltage:

1. Select AC freq/volt selector to generator to be checked.

2. Place DC voltmeter selector to PMG/EXC position.

   a. Field switch off . . . . 53 ± 3 volts

   b. Field switch on (normal) 7 to 22 volts

   c. Field switch on (fault) 36 to 40 volts

GENERATOR DRIVE DISCONNECT

1. Check affected generator load bus for power. If bus tie relay open, close it.

2. Select AC freq/volt selector to affected generator.

3. Select DC voltmeter selector to PMG/EXC position.

4. Operate CSD disconnect switch while monitoring PMG voltage. Disconnect action is verified by PMG voltage slowly dropping to zero.

5. When making appropriate log book entry, note if PMG voltage indications verified disconnect.

6. If PMG voltage did not confirm a disconnect, check circuit breaker CSD Control A-4. If unable to disconnect, be prepared for a possible engine shutdown.

NOTE

Engine must be at or above idle RPM before operating disconnect switch.

INOPERATIVE TR (ZERO AMPERAGE)

1. Select the DC voltmeter to the affected TR position.

2. Place the affected TR switch OFF.

3. If the voltmeter reads zero, the TR is inoperative or current limiters are blown.

POWER CHANGEOVER, NO.2 OR NO.3 TR INOPERATIVE

1. Prior to placing the external power switch to parallel, place the battery switch to EMERGENCY.

TRIPPED CIRCUIT BREAKERS/BLOWN FUSE POLICY

One replacement of a blown fuse or one reset of a blown C. B. in flight is permitted. In the event of a fuse replacement in a 3∅ circuit, all three should be replaced.

If fuse blows or C. B. trips again, a second replacement or reset is permitted only if fault is corrected or in some manner isolated. Further replacement or reset shall not be attempted unless a greater emergency is created by leaving the circuit open.

* * *

CSD DRIVE MALFUNCTION INDICATOR LIGHT

Indicates low oil pressure in CSD.
A4 - CSD WARNING.

BUS-TIE INDICATOR LIGHT

Indicates generator load bus is NOT connected to the sync. bus.
B3 - GEN AC SYS IND LTS.

GENERATOR LINE RELAY INDICATOR LIGHT

Indicates generator is NOT connected to load bus.
B3 - GEN AC IND LTS.

AC AMMETER

Indicates total amperage in "B" phase.
NO CIRCUIT PROTECTION.

FIELD RELAY INDICATOR LIGHT

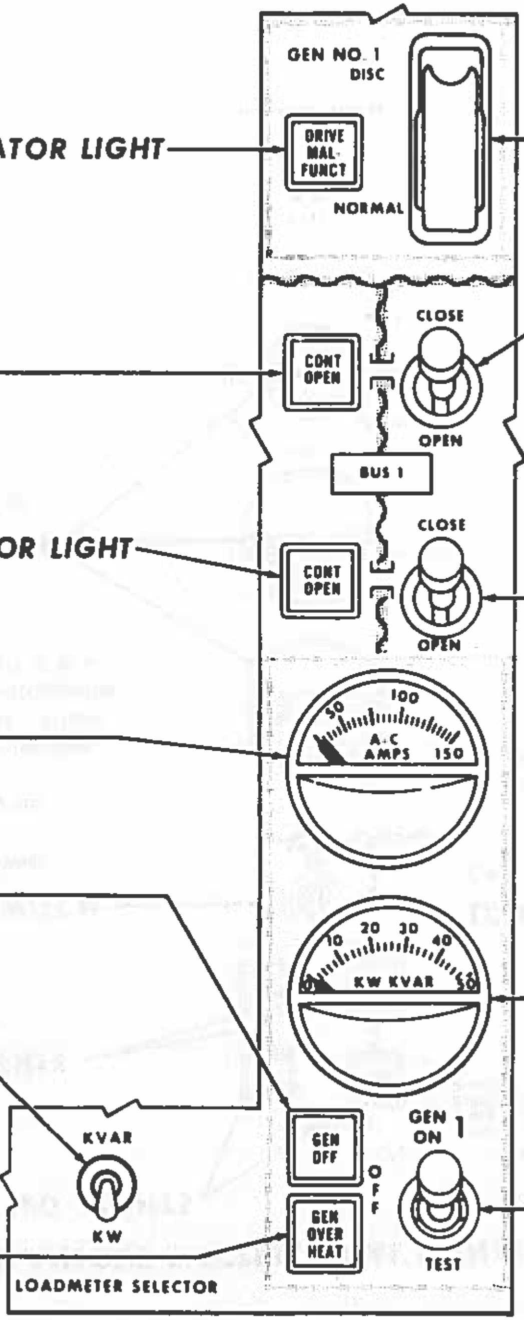
Indicates that generator is inoperative.
B3 - GEN AC SYS IND LTS.

LOADMETER SELECTOR

Selects KW or KVAR readings for loadmeters.
B3 - KW KVAR SEL & GND CREW CALL.

GENERATOR OVERHEAT INDICATOR LIGHT

Indicates generator is overheated. (Also lights Master Caution).
B3 - GEN AC IND LTS.



CSD DRIVE DISCONNECT SWITCH

Stops rotation of CSD and generator.
A4 - CSD CONTROL.

BUS-TIE RELAY CONTROL SWITCH

CLOSE - Allows bus tie relay to connect load bus to sync. bus if proper conditions exist in paralleling circuitry.
OPEN - Disconnects load bus from sync. bus.
B3 - GENERATOR AC POWER CONTROL OR IF EXTERNAL POWER IS ON. CURRENT LIMITER IN ELECTRICAL COMPT.

GENERATOR LINE RELAY CONTROL SWITCH

CLOSE - Allows line relay to connect generator to respective load bus if proper conditions exists in paralleling circuitry.
OPEN - Disconnects generator from its load bus.
NO CIRCUIT PROTECTION.

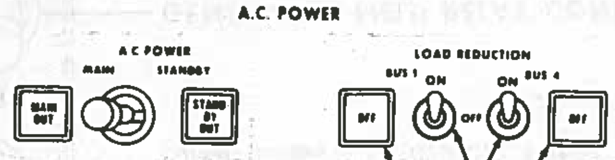
LOADMETERS

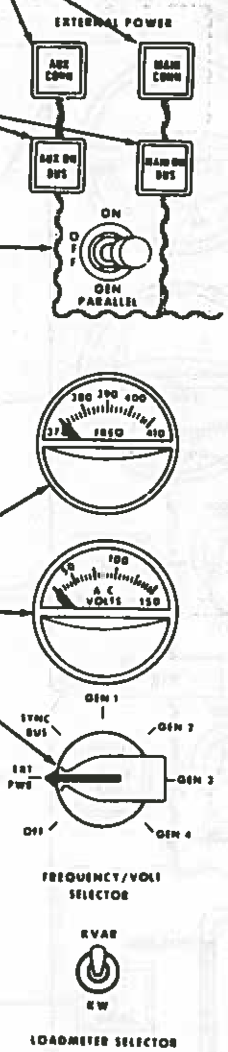
Read KW or KVAR as selected
Current limiters in ELECTRICAL COMPT.

GENERATOR FIELD RELAY CONTROL SWITCH

ON - Turns generator on, if up to speed.
OFF - Makes generator inoperative.
TEST - Turns generator on, if up to speed, but prevents line relay from closing
NO CIRCUIT PROTECTION.

MISCELLANEOUS ELECTRICTRCAL CONTROLS AND INDICATORS





EXTERNAL POWER CONNECTED LIGHTS

Indicates external power available at receptacles.

EXTERNAL POWER ON BUS LIGHTS

Indicates external power is connected to sync bus.

B3 - GEN AC SYS IND LTS 1 & 4

EXTERNAL POWER CONTROL SWITCH

ON - Connects external power to sync bus.

OFF - Removes external power from sync bus.

GEN PARALLEL - Connects left hand operating generator to sync bus. Allows other generators to autoparallel.

B4 - GEN AC SYS IND LTS 1 & 4 & C/L IN E & E COMPT.

A.C. VOLTMETER,FREQUENCY INDICATOR, & SELECTOR SWITCH

Meters indicate voltage and frequency of the source selected with the selector switch.

C/L'S IN E & E COMP.

LOAD REDUCTION LIGHTS

ON - When power is removed from respective bus by load reduction relay being open.

B3 - GENERATOR AC POWER CONT 1 & 4.

LOAD REDUCTION SWITCHES

ON - Allows available power to be supplied to respective load bus, (except when power source is EXT PWR main plug only).

OFF - Reduces load by removing power from respective load bus.

B3 - GENERATOR AC POWER CONT NO. 1 & NO. 4.

C. D.C. POWER CONTROLS AND INDICATORS

D.C. VOLTMETER AND SELECTOR SWITCH

Reads D.C. voltage as selected by the selector switch.

C/L AT BATTERY BUS

BAT - Reads battery voltage or battery charger voltage.

C/L AT BATTERY BUS.

T-R POSITIONS - Reads voltage at output of selected T-R. (T-R voltage and/or bus voltage.)

C/L'S IN 298 BLKHD, (D.C. BUS AREA)

GEN PMG/EXC - (Generator selected by FREQUENCY/VOLT SELECTOR) reads generator field voltage (if generator is operating) or PMG voltage (if GEN FIELD switch is off or generator is not operating.)

FUSES IN E & E COMPT.

EMERG BUS OFF LT

Indicates loss of power to the emergency D.C. bus (when battery switch is in NORMAL or EMER).

B4 - BAT REL CONT OR C/L AT BATTERY BUS.

ESS BUS OFF LT

Indicates loss of power to the essential D.C. bus, (when battery switch is in NORMAL or EMER).

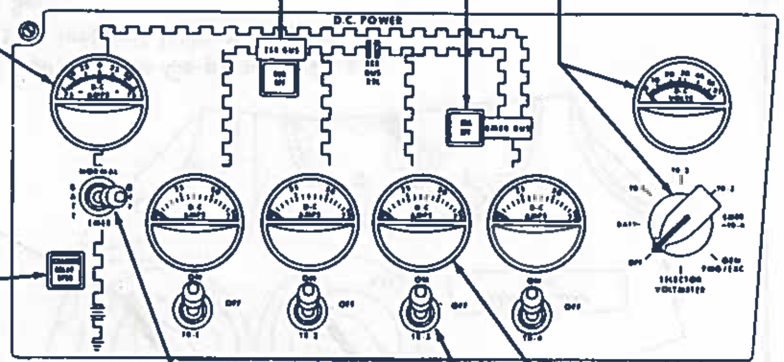
B4 - BAT REL CONT OR C/L AT BATTERY BUS.

BATTERY AMMETER

Minus (-) reading indicates battery charge rate.

Plus (+) reading indicates battery discharge rate.

NO CIRCUIT PROTECTION



CHARGER RELAY OPEN LT

Indicates battery is not connected to charger (when battery switch is in NORMAL or EMER).

B4 - BAT REL CONT OR C/L AT BATTERY BUS.

BATTERY SWITCH

NORMAL - Places battery on charge if charging power available.

OFF - Battery not on charge and not on bus.

EMER - Connects battery to EMER D.C. bus and isolates ESS D.C. bus from EMER D.C. bus.

B4 - BAT REL CONT OR C/L AT BATTERY BUS.

T-R AMMETERS

Each reads the ammerage load for respective T-R.

NO CIRCUIT PROTECTION.

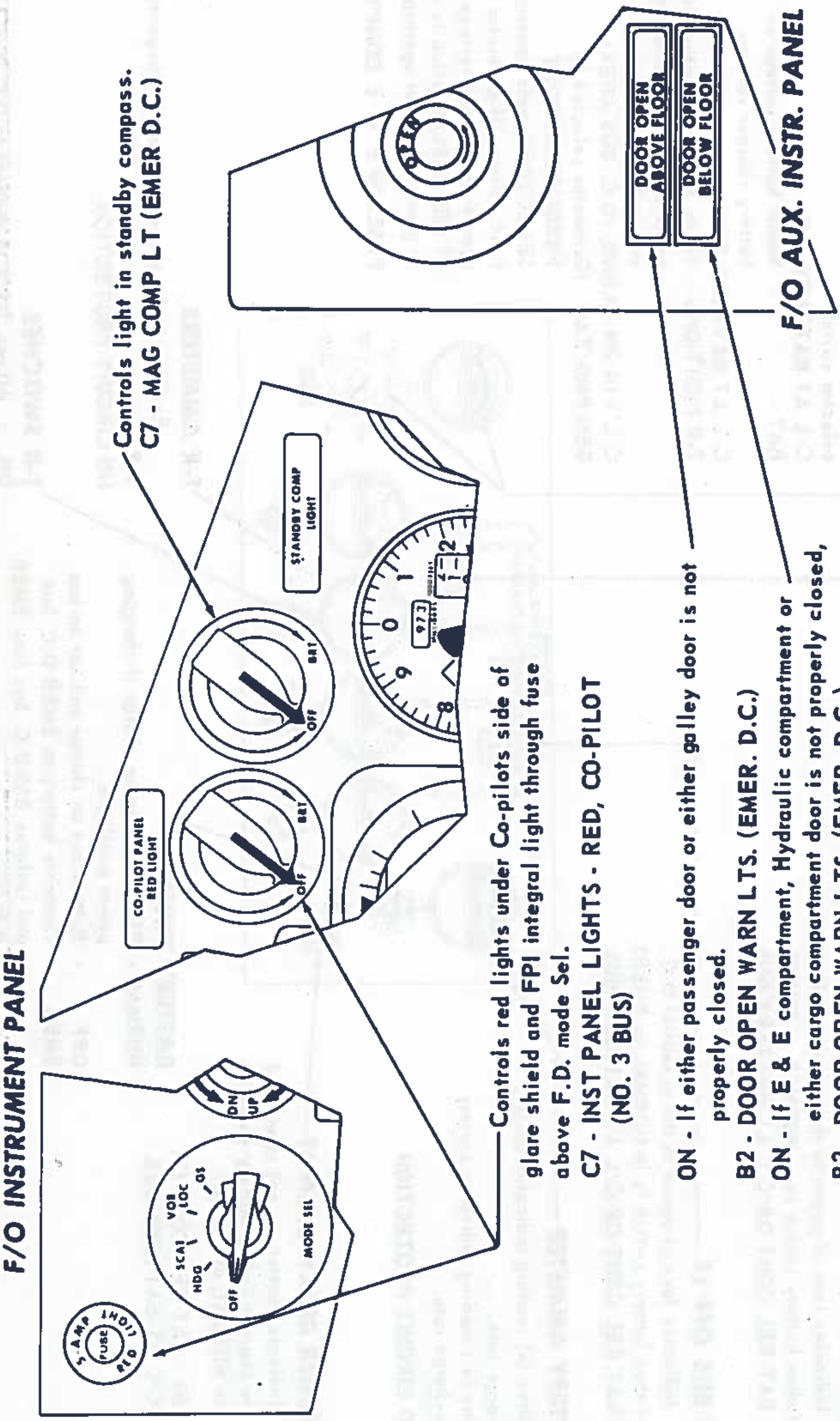
T-R SWITCHES

ON - Allows T-R's to connect to D.C. busses.

OFF - Removes T-R output from bus.

C/L'S IN 298 BLKHD NEAR D.C. BUSSES.

D. F/O INST. & DOOR WARN LIGHTS



Controls light in standby compass.
C7 - MAG COMP LT (EMER D.C.)

Controls red lights under Co-pilots side of glare shield and FPI integral light through fuse above F.D. mode Sel.
C7 - INST PANEL LIGHTS - RED, CO-PILOT (NO. 3 BUS)

ON - If either passenger door or either galley door is not properly closed.
B2 - DOOR OPEN WARN LTS. (EMER. D.C.)

ON - If E & E compartment, Hydraulic compartment or either cargo compartment door is not properly closed,
B2 - DOOR OPEN WARN LTS. (EMER. D.C.)

(4268)

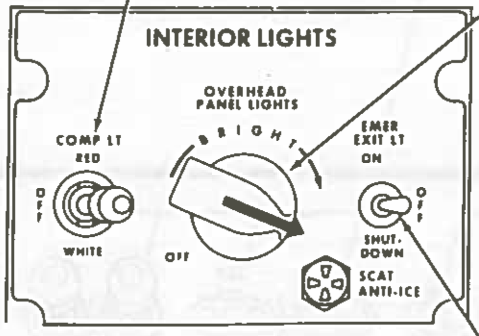
INTERIOR LIGHTING CONTROLS

COCKPIT DOME LIGHT SWITCH

Controls 2 white or two red cockpit dome lights.
C7 - COCKPIT DOME LTS.

OVERHEAD PANEL LIGHT CONTROL

Controls integral panel lights on overhead switch panel.
C7 - PED & OVHD PNL LTS.



EMERGENCY EXIT LIGHT SWITCH

Controls emergency lights

ON	-	Manually turns lights on.
OFF	-	Lights will come on automatically with a loss of emergency or essential DC power.
SHUTDOWN	-	Prevents lights from coming on with a loss of emergency or essential DC power.

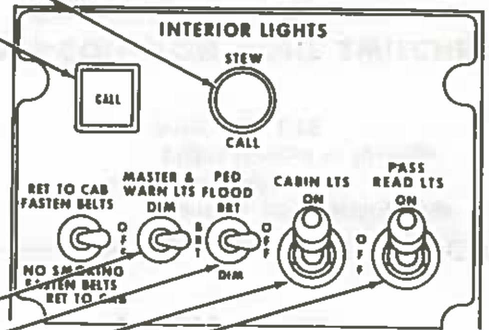
A9 - CONT DC.

HOSTESS CALL SWITCH

Operates chime in cabin. If Pilots hand set is off hook, will also light red "PILOT" call lights.
B1 - PASS CALL SYS FWD.

HOSTESS TO PILOT CALL LIGHT

Illuminated by actuations of "PILOT" call buttons on either PA control panel. Chime in cockpit also sounds.
B1 - PASS CALL SYS FWD.



WARNING LIGHT DIMMING SW

Most warning lights, if ON, can be dimmed by this switch.
B2 - MASTER & WARN LTS CONT.

PEDESTAL FLOOD LIGHT SWITCH

Controls lights in ceiling to illuminate pedestal and overhead panel.
B1 - PED FLOOD & LDG LTS IND LTS.

PASSENGER READING LIGHTS OVERRIDE SWITCH

OFF - position extinguishes all cabin reading lights.
B2 - PILOT'S OVERRIDE PASS LTS.

CABIN LIGHTS OVERRIDE SWITCH

OFF - position extinguishes all cabin fluorescent lights.
C6 - CABIN LTS CONTROL.

EXTERIOR LIGHTING CONTROLS

LANDING LIGHTS EXTENDED INDICATOR LIGHTS

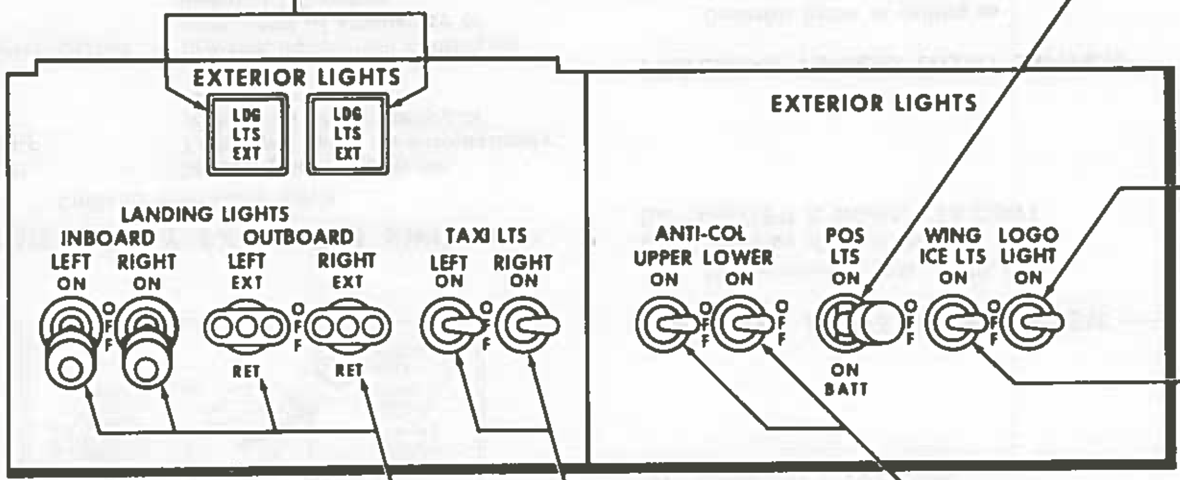
Indicates outboard landing lights are in extended position. (Airspeed restrictions apply.)

B1 - POS LTS CONT - O/B LDG LT IND - PED FLD LTS

POSITION LIGHT SWITCH

Controls navigation (position) lights on wing tips and tail, also wheel well lights if gear is not up.

B1 - POS LTS CONT - O/B LDG LT IND - PED FLD LTS
B3 - W W LTS & POS LTS CONT
B3 - POS LTS



LOGO LIGHT SWITCH

Controls flush spotlights located in the horizontal stabilizer.

A9 - LOGO LIGHTS.

WING ICE LIGHT SWITCH

Controls wing leading edge illumination light.

Lights located in fuselage.

B4 - WING ICE LTS.

ANTI-COLLISION LIGHT SWITCHES

Controls upper and lower anti-collision (beacon) lights.

B1 - ANTI-COL LTS UPPER - LOWER (2)

LANDING LIGHT SWITCHES

INBOARD - Control the fixed landing lights located inboard in each wing leading edge.

B1 - INBOARD LDG LTS CONT - LH - RH (3).

OUTBOARD - Control the extendible landing lights located on the lower surface of the wings near the wing tips.

B1 - OUTBOARD LDG LTS - LH - RH (2).

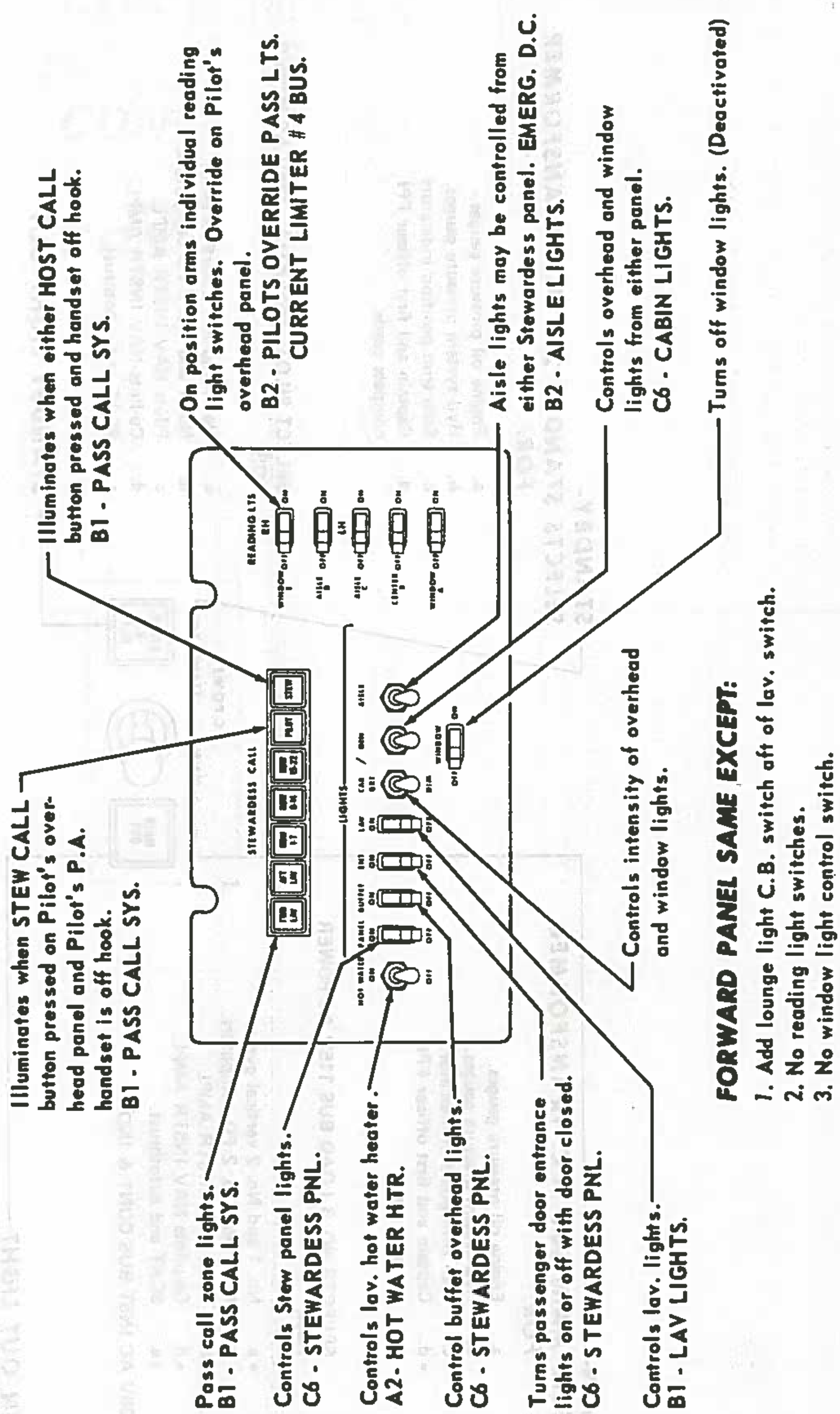
TAXI LIGHT SWITCHES

Controls the taxi lights located inboard in each wing leading edge.

These light beams are directed at fixed 45° angles to right and left. Use recommended for runway turnoff guidance.

C6 - TAXI LTS.

G. AFT HOSTESS PANEL



AC POWER SELECTOR SWITCH

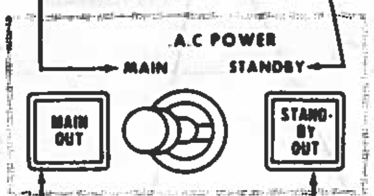
***MAIN*-**
SELECTS MAIN 26V A.C. TRANSFORMER FOR:

a. Engine oil pressure gauges.
b. Hyd system pressure gauges.
c. Stab trim position indicator.
* d. Captain and first officer FPI compass cards.

SELECTS NO. 3 LOAD BUS 115V AC POWER FOR:

* a. No. 1 and No. 2 vertical gyros.
* b. No. 1 and No. 2 FD computers.
* c. Pilots NAV INSTR AMPL.
* d. Co-pilots NAV INSTR AMPL.
* e. SCAT and autothrust.

B4 - 26V AC INST BUS CONT & IND.



***STANDBY*-**
SELECTS STANDBY 26V A.C. TRANSFORMER FOR:

a. Engine oil pressure gauges.
b. Hyd system pressure gauges.
c. Stab trim position indicators
d. Captain and first officer FPI compass cards.

SELECT PILOTS ESSENTIAL 115V AC POWER FOR:

a. No. 1 and No. 2 vertical gyros.
b. No. 1 and No. 2 FD computers.
c. Pilots NAV INSTR AMPL.
d. Co-ilots NAV INSTR AMPL.
e. SCAT and autothrust.

MAIN OUT LIGHT

Indicates loss of 26V AC from main transformer
B4 - 26V AC INST BUS CONT & IND.

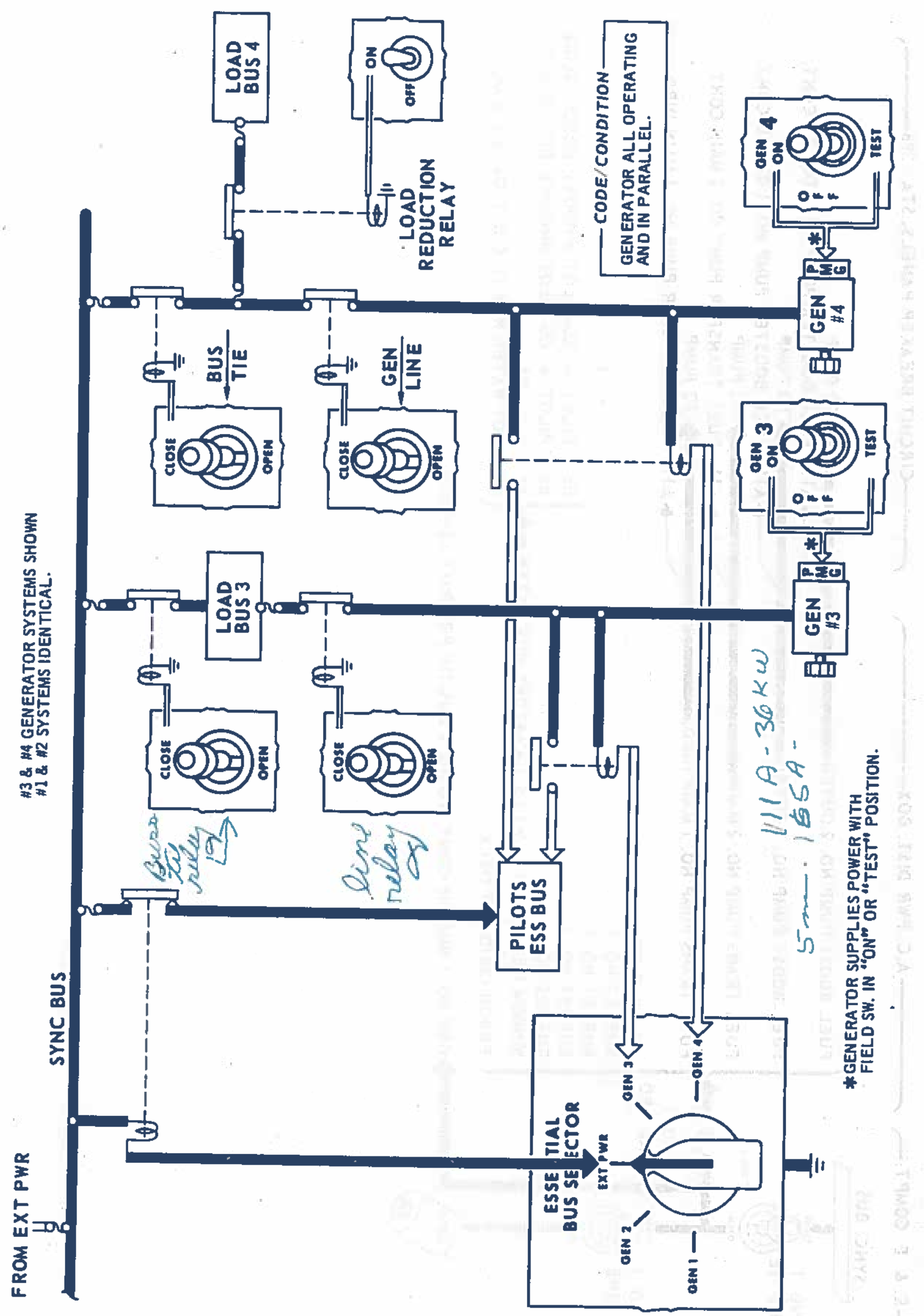
STANDBY LIGHT OUT

Indicates loss of 26V AC from standby transformer.
B4 - 26V AC INST BUS CONT & IND.

* IF A NO. 3 LOAD BUS FAILURE OCCURS POWER FOR THESE UNITS WILL AUTO TRANSFER TO THE STANDBY TRANSFORMER AND THE PILOTS ESS BUS.

(5571)

A. A.C. POWER DISTRIBUTION



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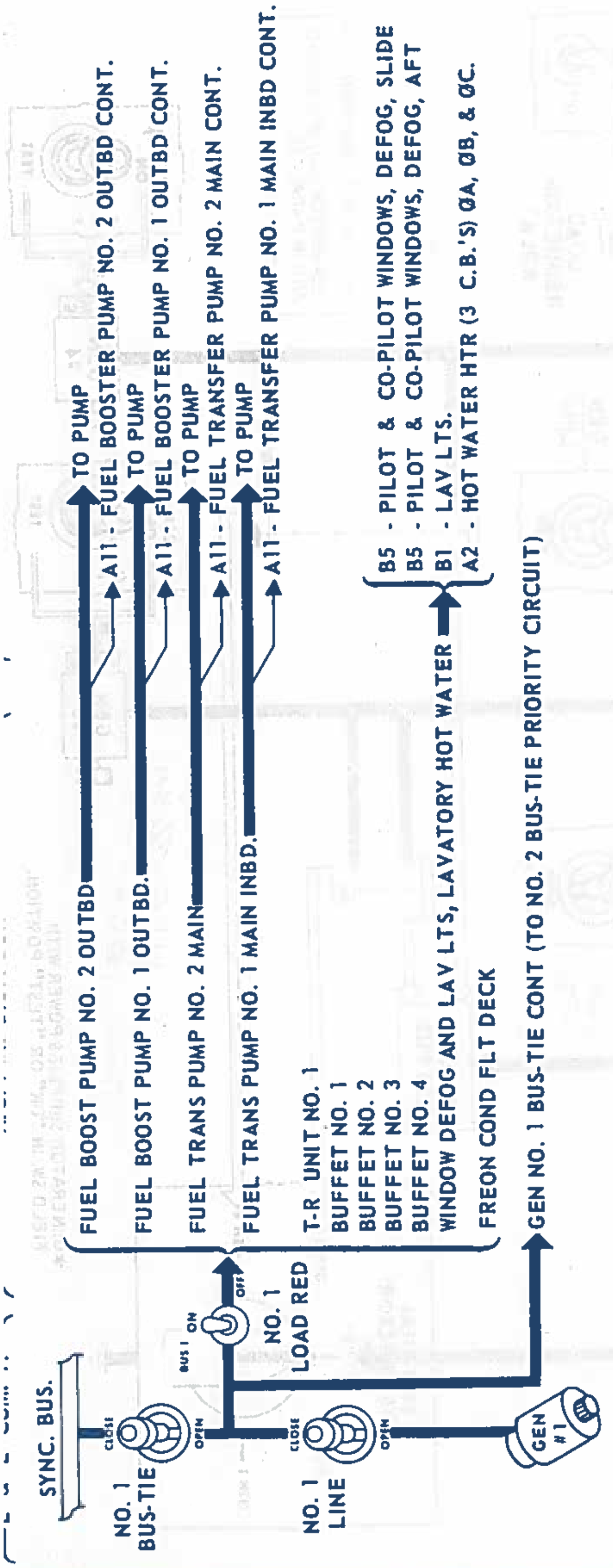
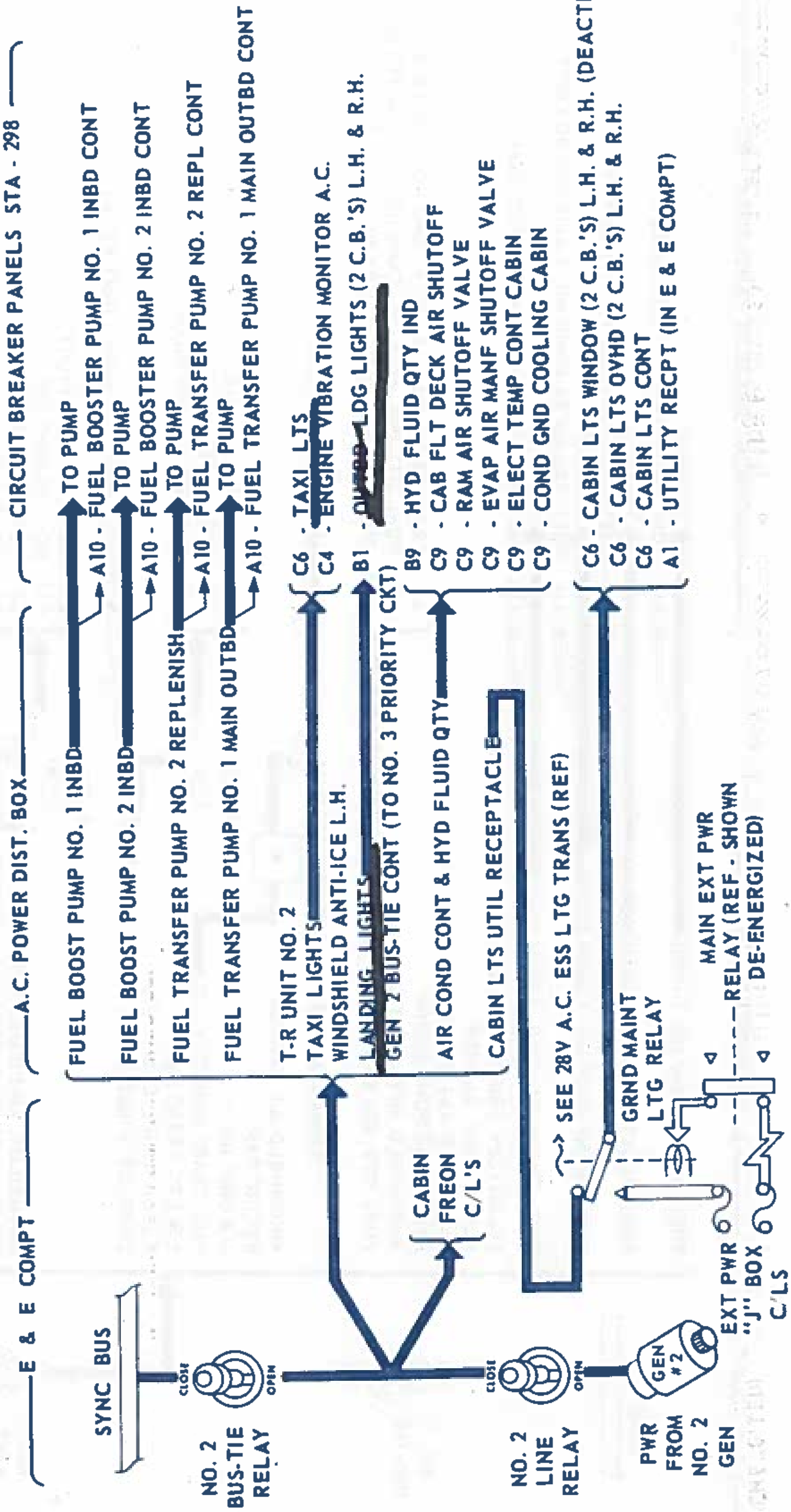
NO. 1 A. C. LOAD BUS

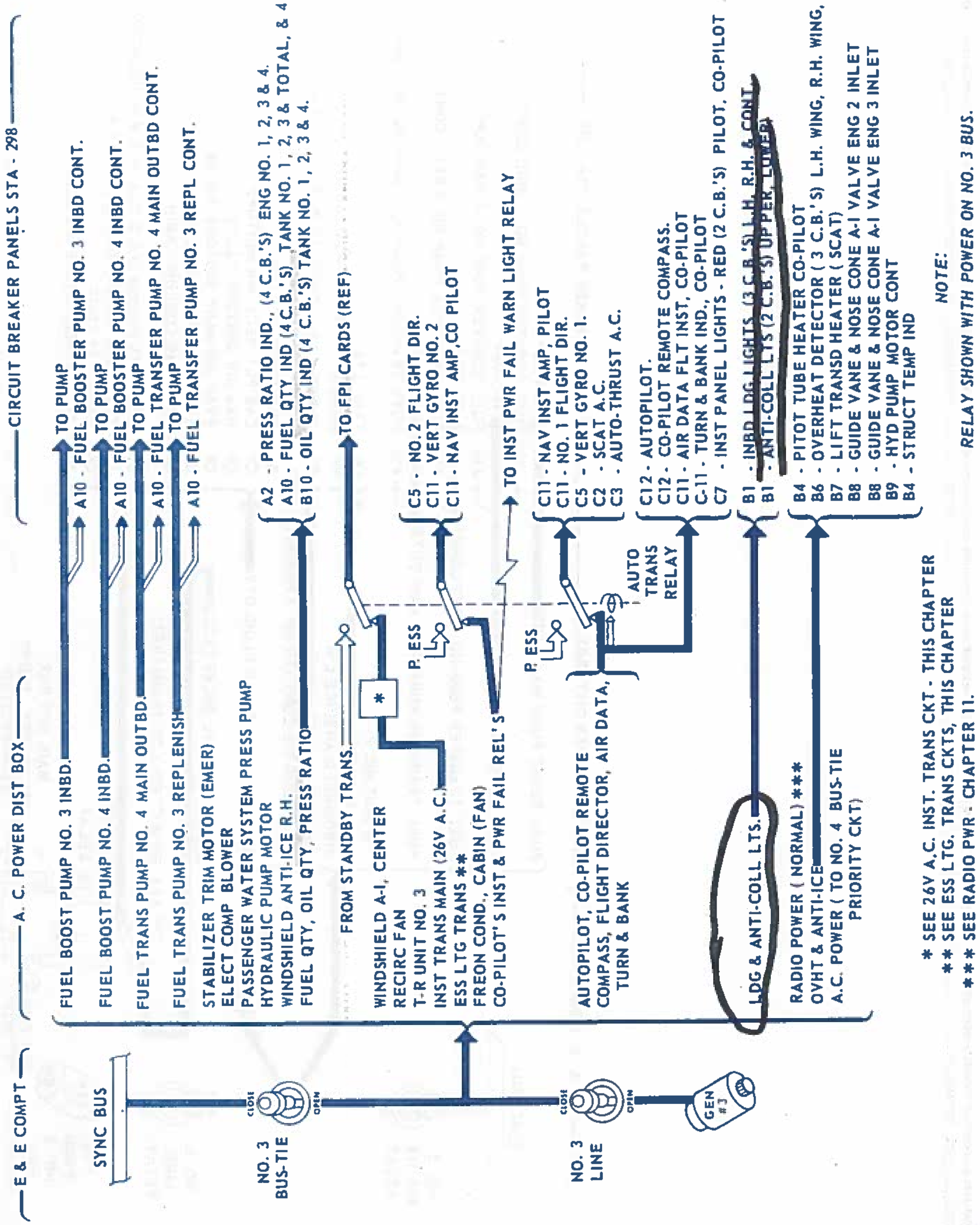


C. NO. 2 A.C. LOAD BUS



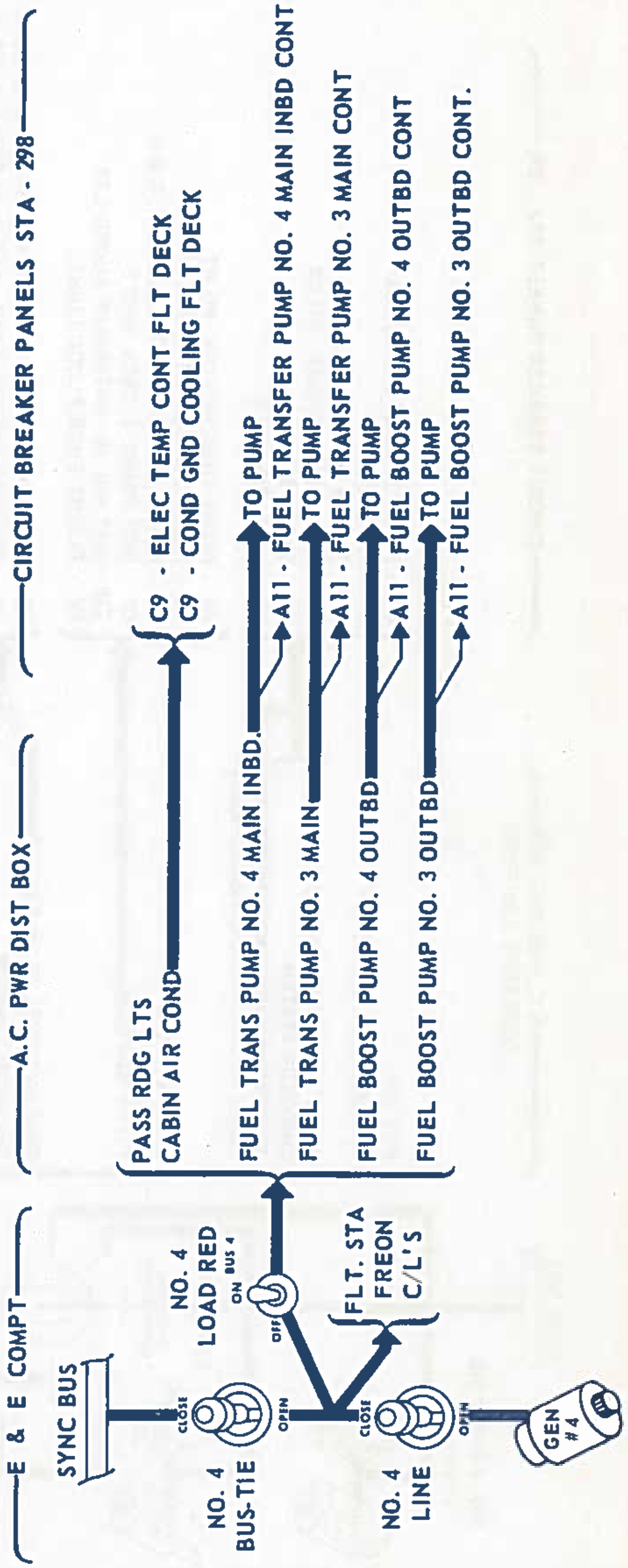
TRANS WORLD AIRLINES
CONVAIR 880
FLIGHT HANDBOOK

D. NO. 3 A.C. LOAD BUS



(4095)

E. NO. 4 A.C. LOAD BUS



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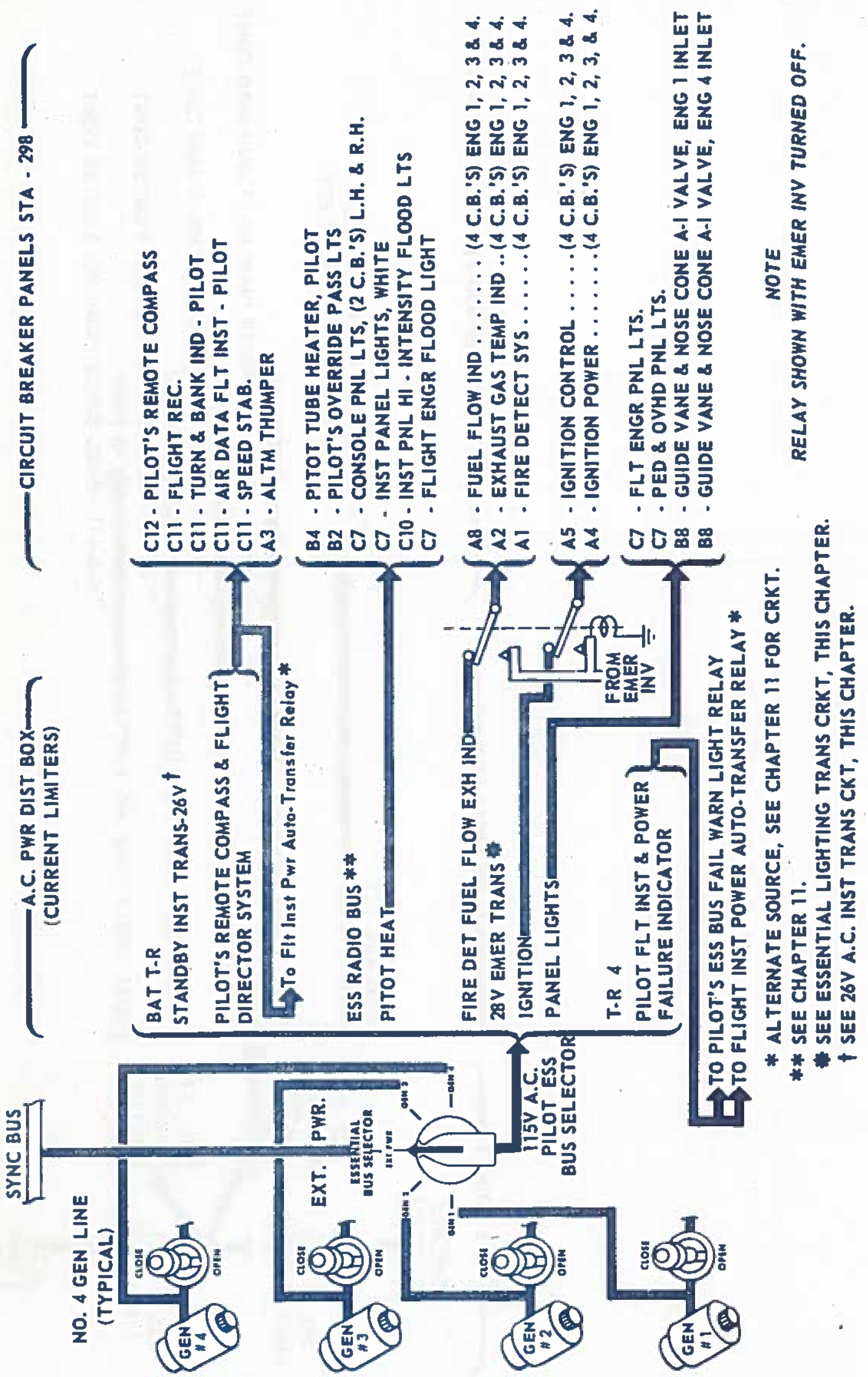
F. PILOT'S ESS. A.C. BUS



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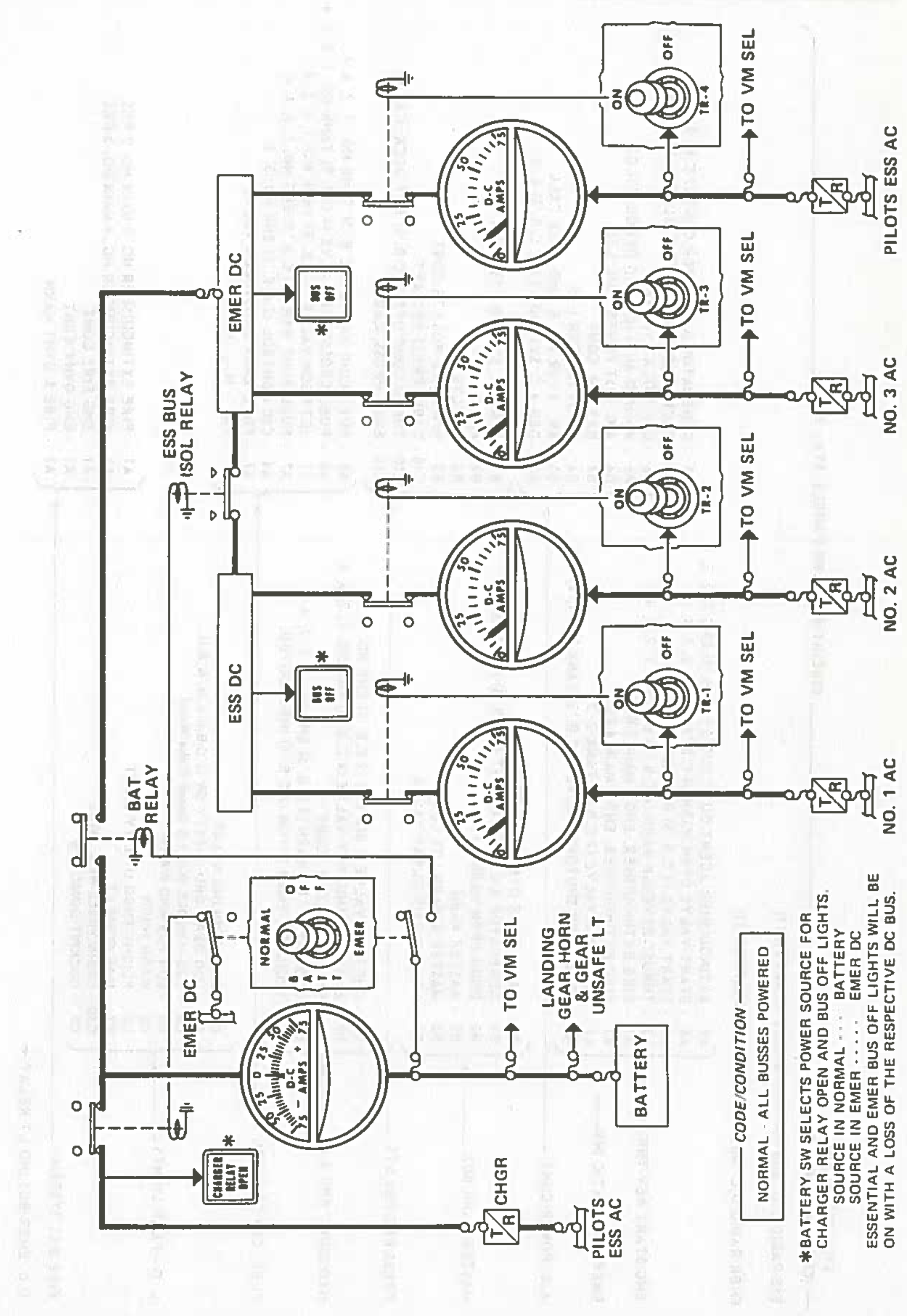

EMER DC
ESS BUS
ISOL RELAY
BUS OFF
ESS DC
BAT
RELAY
NORMAL
EMER
BATT
OFF
CHARGER RELAY OPEN
D-C AMPS
TO VM SEL
LANDING
GEAR HORN
& GEAR
UNSAFE LT
BATTERY
CHGR
PILOTS
ESS AC
ON
OFF
TR-1
TR-2
TR-3
TR-4
NO. 1 AC
NO. 2 AC
NO. 3 AC
PILOTS ESS AC
CODE/CONDITION
NORMAL - ALL BUSSES POWERED
*BATTERY SW SELECTS POWER SOURCE FOR
CHARGER RELAY OPEN AND BUS OFF LIGHTS.
SOURCE IN NORMAL . . . . BATTERY
SOURCE IN EMER . . . . . EMER DC
ESSENTIAL AND EMER BUS OFF LIGHTS WILL BE
ON WITH A LOSS OF THE RESPECTIVE DC BUS.

EMERGENCY D.C. BUS DISTRIBUTION

STA - 298 BLKHD (CURRENT LIMITERS) — CIRCUIT BREAKER PANELS STA - 298

ESS RADIO D.C. BUS → (SEE CHAPTER 11)

EMER RADIO D.C. BUS → (SEE CHAPTER 11)

ENG START REV THR →
- A9 - EXTINGUISHER AGENT OUT LIGHTS (4 C.B.'S) ENG 1, 2, 3, 4.
- A8 - START VALVE OPEN WARN (4 C.B.'S) NO. 1, 2, 3, 4,
- A3 - START VALVE (4 C.B.'S) ENG NO. 1, 2, 3, 4.
- A3 - THRUST REVERSE WARN (4 C.B.'S) ENG NO. 1, 2, 3, 4.
- A1 - FIRE EXTINGUISHER, ENG 1 MAIN 2 RES
- A1 - FIRE EXTINGUISHER, ENG 3 MAIN 4 RES
- A7 - SCAVENGE VALVE (2 C.B.'S) TANK 2, 3.
- A6 - FUEL EMER SHUTOFF VALVE (4 C.B.'S) TANK NO. 1, 2, 3, 4.

EMER IGN STATIC INV →

A.C. POWER CONT →
- B3 - GENERATOR A.C. POWER CONT (2 C.B.'S) 3, 4.
- B6 - EXCESS HEAT WARN LTS & BLEED AIR VALVES, L.H.
- B6 - L.H. ISOLAT VALVE
- B5 - WDSHLD ANTI-ICE AND DEFOG, PILOT
- B4 - A.C. INST POWER FAIL LTS
- B4 - BAT REL CONT
- B4 - PITOT HEATER LTS
- B3 - KW - KVAR SEL & GND CREW CALL
- B3 - GEN A.C. SYS IND LTS (2 C.B.'S) 2, 3.

MASTER WARN BOX →
- B5 - RAIN CLEAR OVERHEAT CONTROL
- B3 - GENERATOR A.C. POWER CONT (2 C.B.'S) NO. 1 GEN 2.
- B2 - DOOR OPEN WARN LTS
- B2 - MASTER WARN
- B2 - MASTER & WARN LTS CONT
- B5 - WDSHLD RAIN CLEAR VALVE

PRESS REG POS LTS →
- B3 - GEN A.C. SYS IND LTS, 1 & 4.
- B2 - AISLE LTS
- B3 - POS LTS
- B3 - W/W LTS & POS LTS CONT
- C10 - CABIN PRESS REG AFT
- C10 - TURBO COMP OFF (2 C.B.'S) FLT DECK, CABIN
- C10 - EMER PRESS, CABIN

HYD CONT, ENG A-I →
- B7 - DUCT LIP VALVE & IND LTS (2 C.B.'S) ENG NO. 1, 4
- B9 - EMER HYD SHUTOFF VALVE (4 C.B.'S) ENG NO. 1, 2, 3, 4.
- B9 - STAB TRIM CONT, EMER
- B8 - HYD PRESS LOW WARN (4 C.B.'S) ENG NO. 1, 2, 3, 4.
- B7 - SPOILERS, EMER PITCH (2 C.B.'S) INBD, OUTBD.

FUEL, CSD CONTROL →
- A6 - FUEL LINE VALVE (4 C.B.'S(TANK NO. 1, 2, 3, 4.
- A6 - FUEL CROSSFEED VALVE (4 C.B.'S) TANK NO. 1, 2, 3, 4.
- A7 - JETTISON VALVE (4 C.B.'S) TANK NO. 1, 2, 3, 4.
- A7 - FUEL PUMP WARN (4 C.B.'S) ENG NO. 1, 2, 3, 4,
- A4 - CSD CONTROL (2 C.B.'S) ENG NO. 3, 4.
- A7 - FUEL EMER CROSSFEED VALVE
- A7 - V_{mo} - M_{no} WARN

L G - FLAP LIGHTS →
- C6 - ELEC COOLING VALVE
- C8 - LDG GEAR GRD SAFETY SW (2 C.B.s) L.H. & R.H.
- C8 - LDG HANDLE SOL (& Speed Brake Warn)
- C8 - LDG POS AND WARN
- C8 - WARN HORN
- C7 - FLIGHT ENGR UTILITY LIGHT
- C7 - MAG COMP LT
- C10 - CABIN PRESS REG, FWD.
- C7 - COCKPIT DOME LTS

FIRE EXT SYSTEM →
- A1 - FIRE EXTINGUISHER NO. 2 MAIN NO. 1 RES.
- A1 - FIRE EXTINGUISHER NO. 4 MAIN NO. 3 RES.
- A1 - ENG FIRE CONT
- A1 - ENG OVHT CONT
- A1 - FIRE & OVHT WARN

D.C. EMER BUS IND LT RELAY →

(3934)

ESS. D.C. PWR. DIST.

STA - 298 BLKHD (CURRENT LIMITERS)

CIRCUIT BREAKER PANELS STA - 298

FUEL PUMP & TEMP IND. →
- A11 - FUEL PUMP WARNING LTS (4 C.B.'S) TANK NO. 1 PUMPS 2, 3, & 4.
- A5 - FUEL TEMP IND.

ENG-HYD OIL & EMER PRESS →
- C10 - CABIN ALT WARN LIGHT
- C10 - EMER PRESS FLIGHT DECK
- C2 - SCAT D.C.
- B10 - ENG OIL TEMP IND (4 C.B.'S) ENG 1, 2, 3, & 4.
- B9 - OIL PRESS LOW WARN (2 C.B.'S) ENG 1, 2, 3, & 4
- B8 - HYD TEMP AND RETURN PRESS WARN (2 C.B.'S) NO. 1, NO. 2.
- B9 - STAB TRIM CONT

AIR TEMP →
- B4 - HYD INTERC'N'T VALVE
- B4 - 26V A.C. INST BUS CONT & IND.
- B3 - ELEC COMPT FAN CONT.
- B3 - PASS WATER CONT & WARN.
- B4 - FREE AIR TEMP IND.

ANTI-SKID & BRAKE - FLAP →
- C4 - ENGINE VIBRATION PICK UP SELECTOR
- C5 - PARKING BRAKE WARN LIGHT
- C8 - FLAP ASYM CONT.
- C6 - ENT RAMP RECEPT (2 C.B.'S) FWD, AFT
- C8 - ANTI-SKID CONT (3 C.B.'S) NLG, MLG - L.H., MLG - R.H.
- C8 - FLAP POS IND
- C10 - TURBO COMP ON, CABIN
- C8 - FREON SYS CONT, CABIN

BUS IND LIGHT RELAY →

PASS CALL, RAIN CLEAR →
- B5 - A-1 LTS.
- B1 - POS LTS CONT - O/B LDG LT IND - PED FLD LTS
- B1 - PASS CALL SYS (2 C.B.s) FWD AFT.
- B5 - WDSHLD ANTI-ICE & DEFOG, CENTER
- B6 - STRUCT OVERHEAT WARN.

ENGINE A-1, EXCESS HEAT →
- B6 - R.H. ISOLATION VALVE AND FUS EXCESS HEAT LIGHT
- B6 - EXCESS HEAT WARN LTS & BLEED AIR VALVES, R.H. WING
- B6 - WING SKIN TEMP OVERHEAT, (2 C.B.'S)
- B7 - BLEED VALVE IND LTS.
- B5 - WDSHLD ANTI-ICE AND DEFOG, CO-PILOTS
- B7 - DUCT LIP VALVE & IND LTS (2 C.B.'S) ENG 2, 3.

ANTI-ICE WING → B5 - ANTI-ICE CONTROL (2 C.B.'S) L.H. WING, R.H. WING

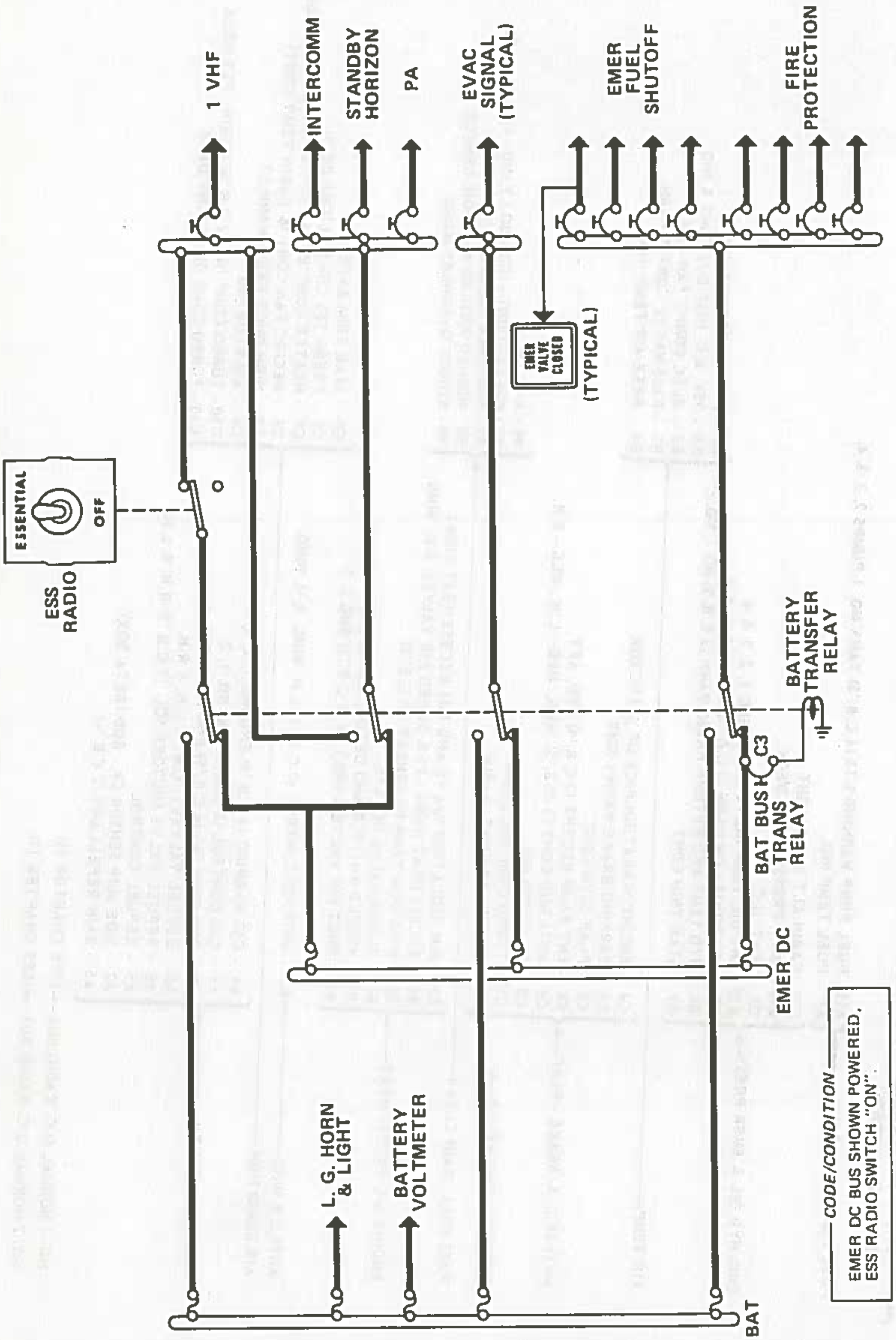
AIR CONDITION →
- C7 - STAB TRIM RATE
- C8 - FREON SYS CONT FLIGHT DECK
- C9 - HEATER CONT RELAY (2 C.B.'S) CABIN, FLT DECK
- C9 - RECIRC FAN CONT (& CABIN TEMP CONT)
- C9 - HIGH DUCT PRESS WARN LT
- C9 - AIR FLOW IND
- C10 - TURBO COMP IND (2 C.B.'S) CABIN, FLT DECK
- C10 - TURBO COMP ON FLIGHT DECK

FUEL, CSD CONT →
- A4 - CSD WARNING (4 C.B.'S) ENG NO. 1, 2, 3, 4.
- A4 - CSD CONTROL (2 C.B.'S) ENG NO. 1, 2.
- A8 - GRD COOLING (4 C.B.'S) ENG NO. 1, 2, 3, 4.
- A5 - DEFUEL VALVES (2 C.B.'S) L.H. & R.H.
- A5 - REFUEL VALVE SHUTOFF SOL (2 C.B.'S) R.H. & L.H.
- A5 - REFUEL CONTROL
- A2 - SIDE SLIP SENSOR CK - RUD (BETA BOX)
- A5 - RAIN REPELLANT (2 C.B.'s)

NO. 1 NORMAL D.C. RADIO BUS → (SEE CHAPTER 11)

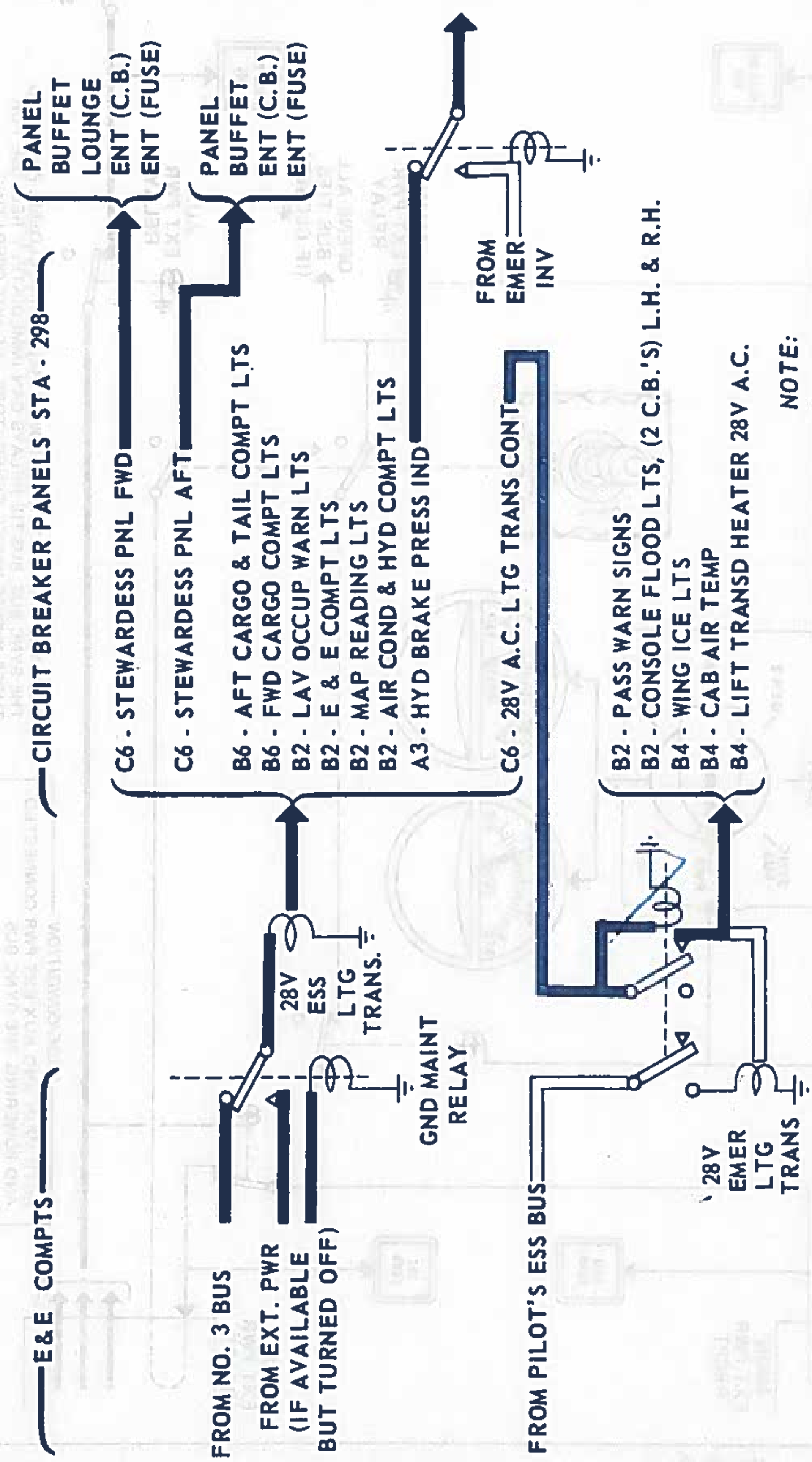
NO. 2 NORMAL D.C. RADIO BUS → (SEE CHAPTER 11)

EMERGENCY DC POWER



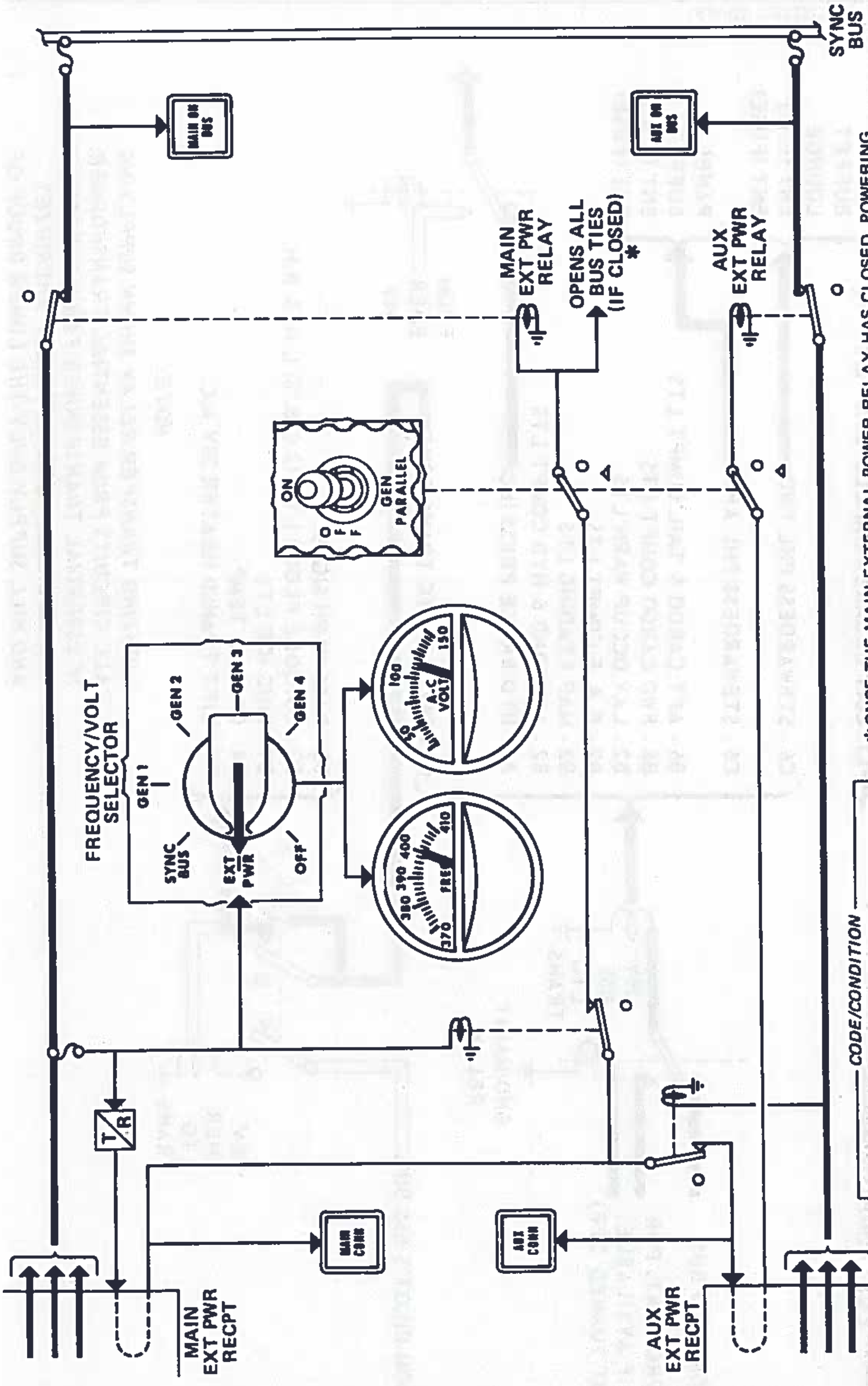
(3933)

K. 28V A.C. ESS. & EMER. LIGHTING TRANS.



NOTE:

LIGHTING TRANSFER RELAY SHOWN SUPPLYING ALL CIRCUITS FROM ESSENTIAL TRANSFORMER. IF ESSENTIAL TRANSFORMER FAILS EMERGENCY TRANSFORMER AUTOMATICALLY ENERGIZES AND WILL SUPPLY ONLY THE LOWER GROUP OF CIRCUITS.

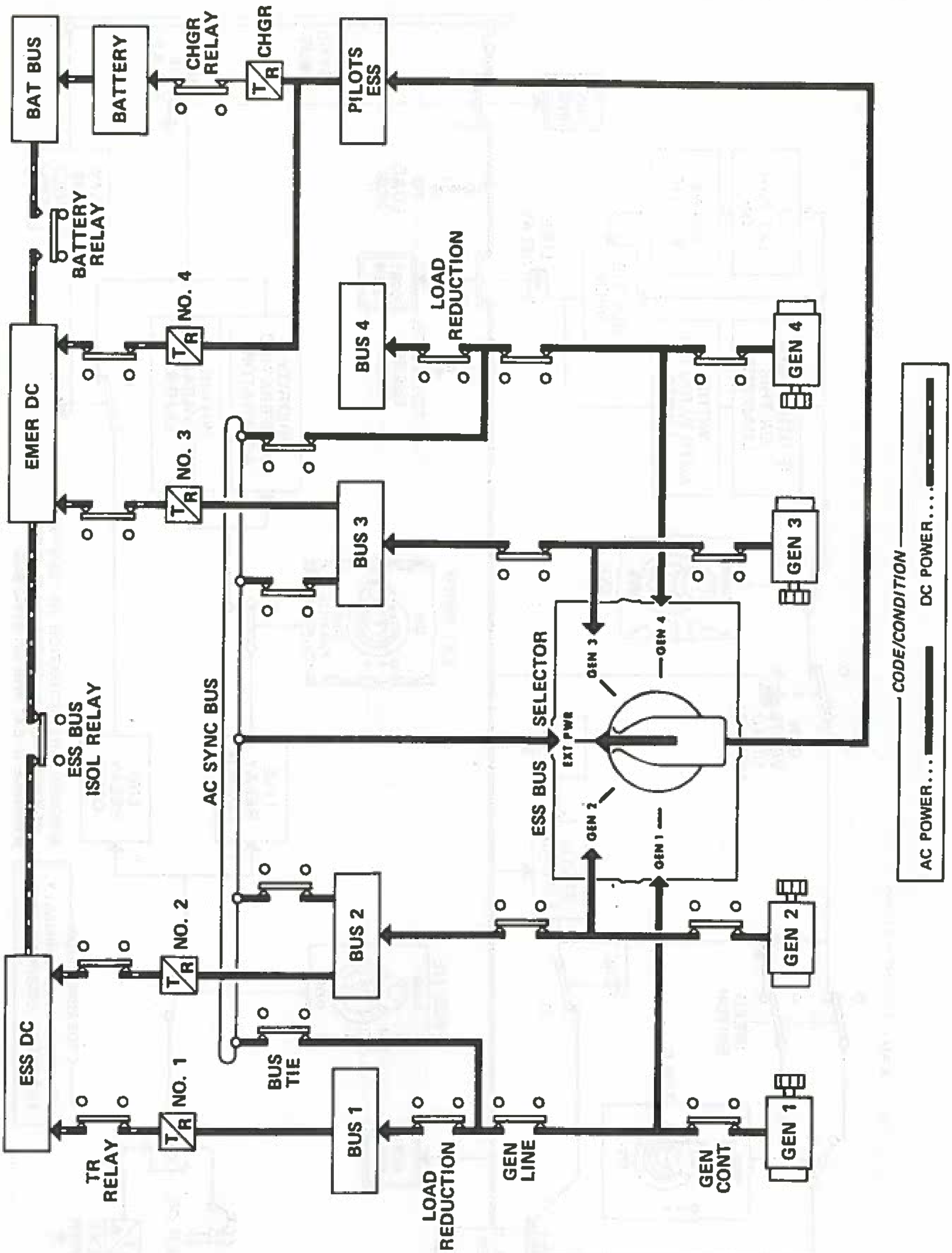


*ONCE THE MAIN EXTERNAL POWER RELAY HAS CLOSED, POWERING THE SYNC BUS, BUS-TIE RELAYS CAN IMMEDIATELY RECLOSE FOR THOSE BUSSES WHOSE GENERATORS ARE NOT OPERATING.

CODE/CONDITION
BOTH MAIN AND AUX EXT PWR CONNECTED AND POWERING THE SYNC BUS.

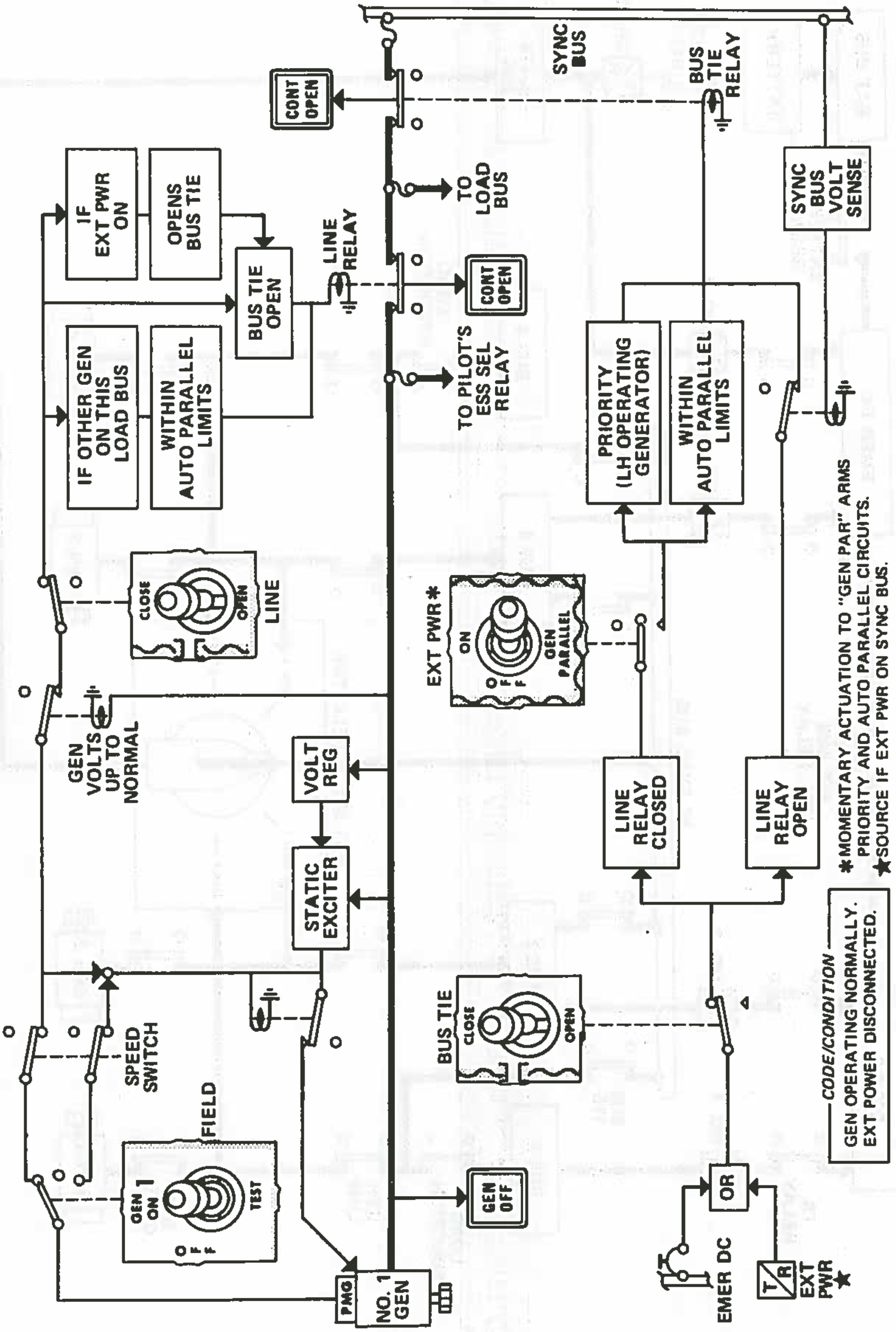
(4169)

S. ELECTRICAL SYSTEM



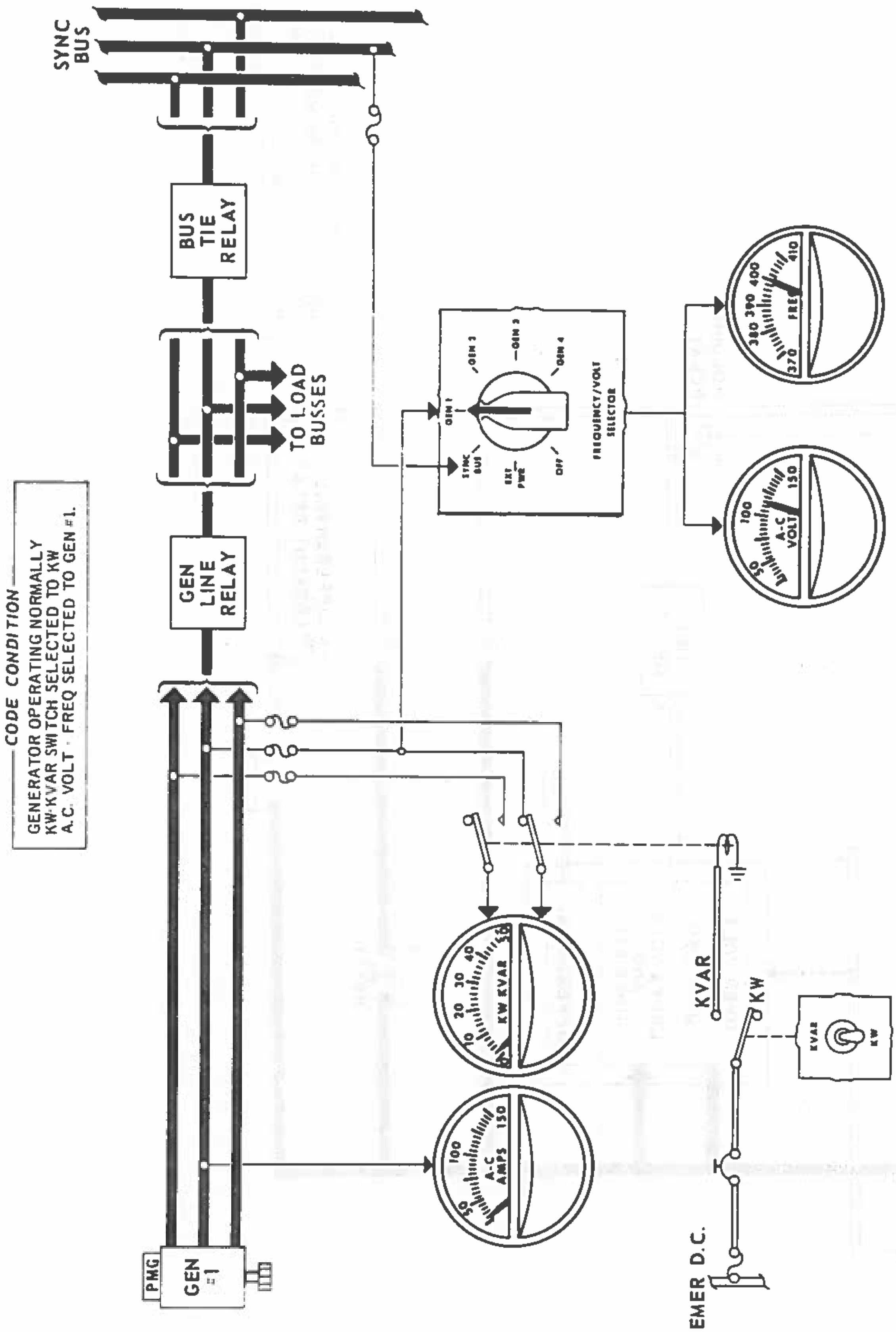
(5470)

N. GENERATOR RELAY CONTROL

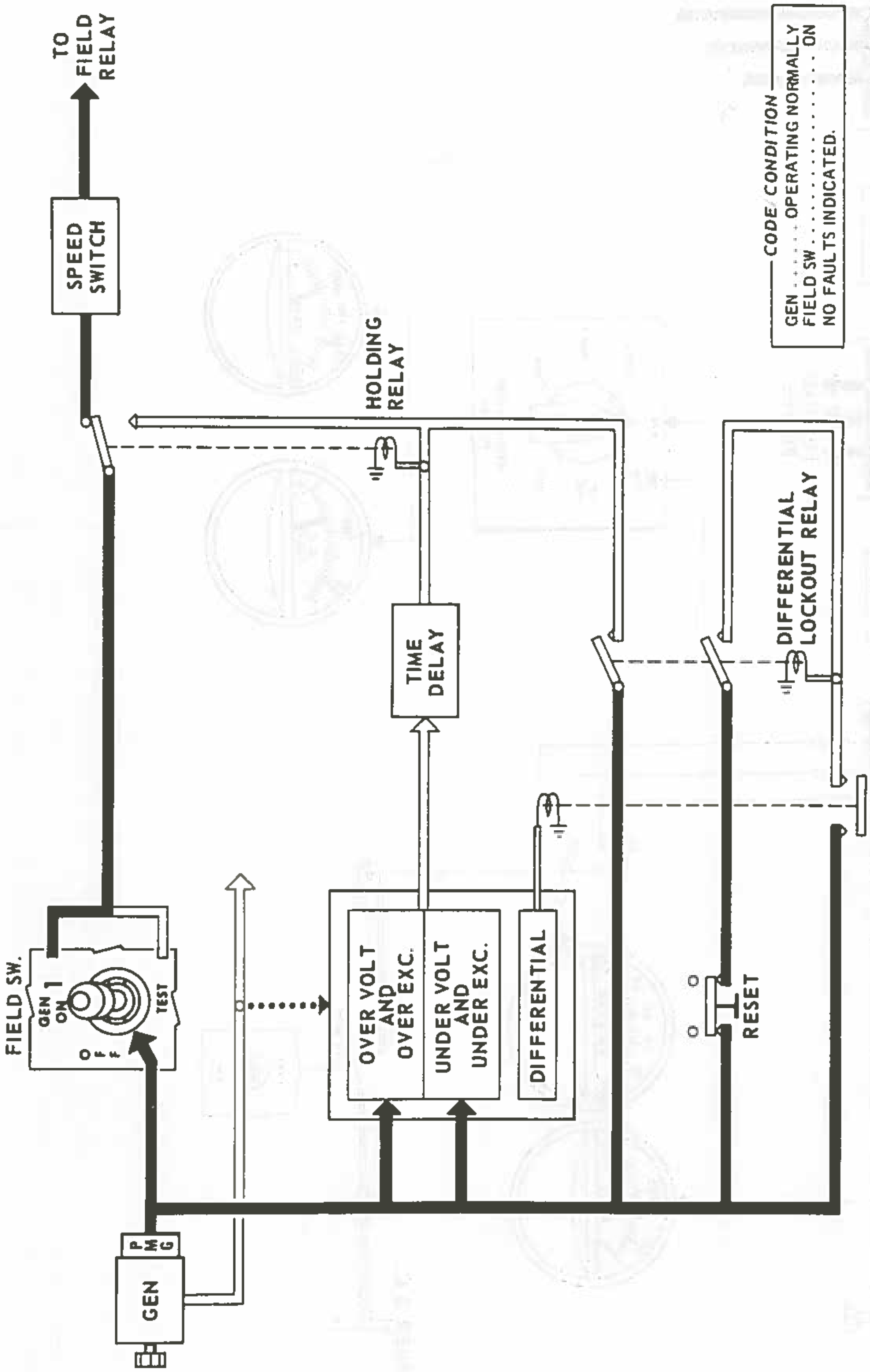


(4171)

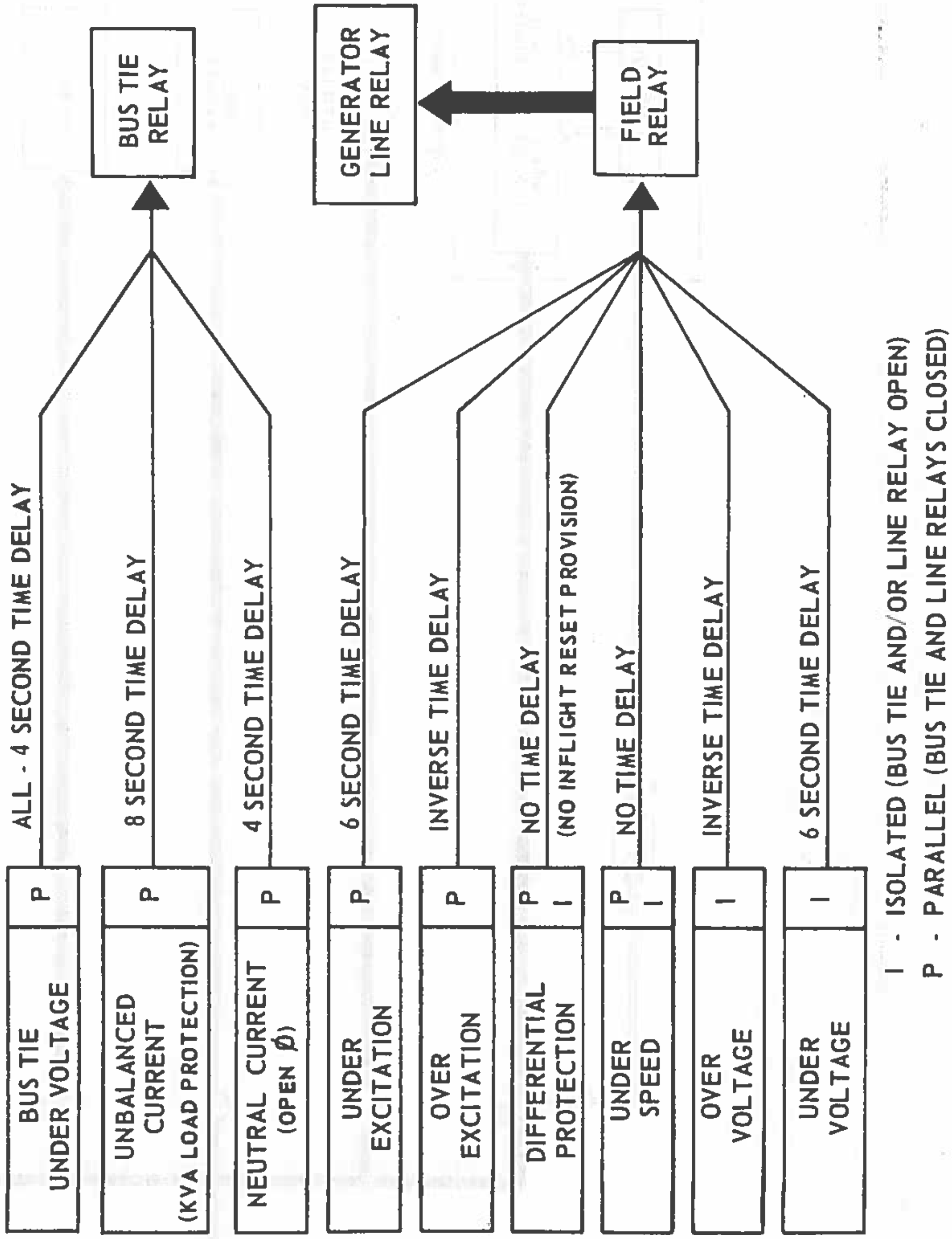
O. A.C. GENERATOR INDICATIONS



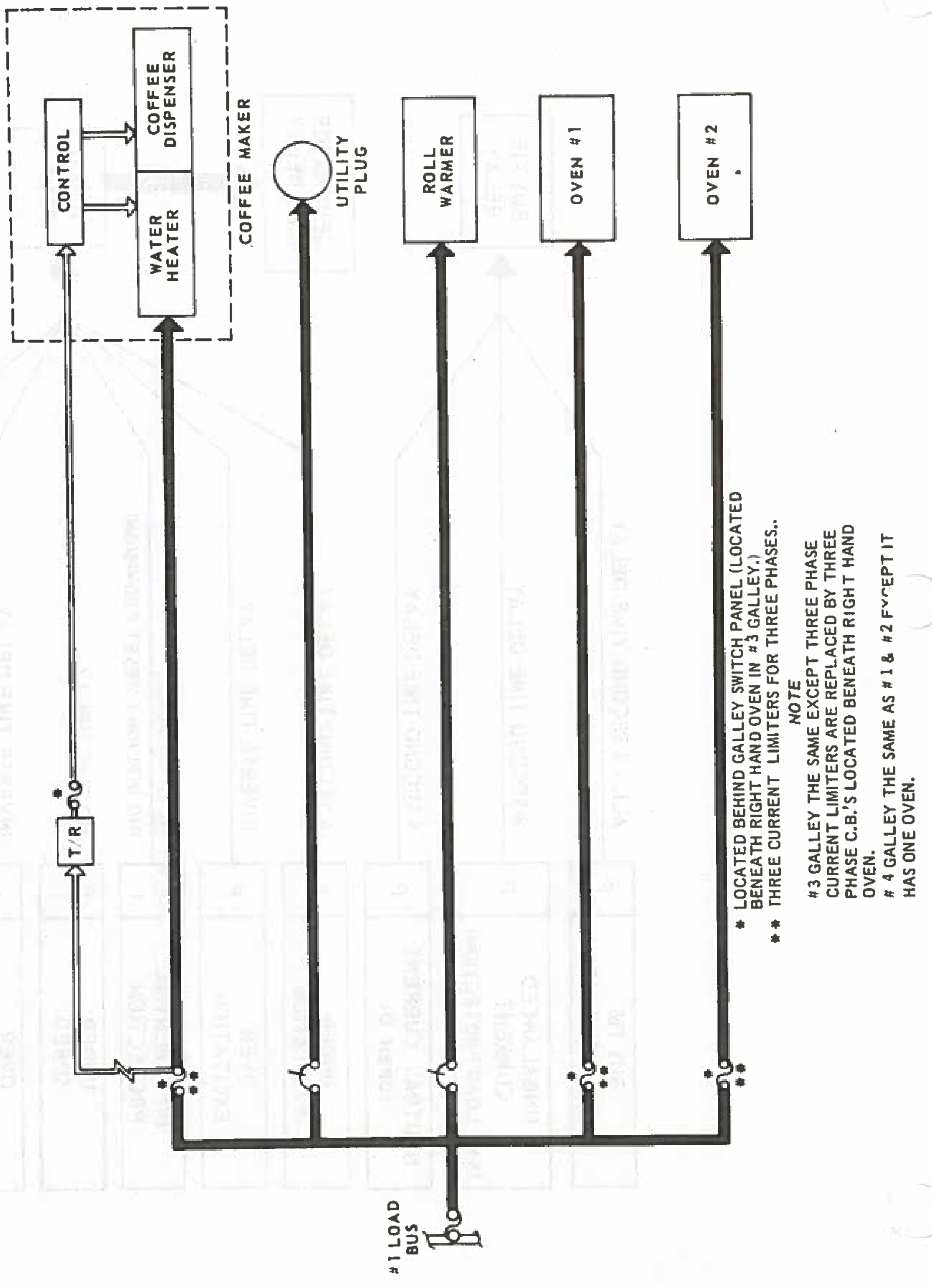
P. FAULT PROTECTION SYSTEM



(4828)


BUS TIE RELAY
GENERATOR LINE RELAY
FIELD RELAY
BUS TIE UNDER VOLTAGE
P
ALL - 4 SECOND TIME DELAY
UNBALANCED CURRENT (KVA LOAD PROTECTION)
P
8 SECOND TIME DELAY
NEUTRAL CURRENT (OPEN Ø)
P
4 SECOND TIME DELAY
UNDER EXCITATION
P
6 SECOND TIME DELAY
OVER EXCITATION
P
INVERSE TIME DELAY
DIFFERENTIAL PROTECTION
P I
NO TIME DELAY
(NO INFLIGHT RESET PROVISION)
UNDER SPEED
P I
NO TIME DELAY
OVER VOLTAGE
I
INVERSE TIME DELAY
UNDER VOLTAGE
I
6 SECOND TIME DELAY
I - ISOLATED (BUS TIE AND/OR LINE RELAY OPEN)
P - PARALLEL (BUS TIE AND LINE RELAYS CLOSED)

R. GALLEY ELECTRICAL POWER



(4231)

ELECTRICAL POWER SYSTEM

POWER SYSTEM DESCRIPTION
Primary electrical energy on the 880 is regulated 115/200V, three-phase, 400 cycle alternating current provided by 4 engine-driven AC generators. Electrical power for most lighting is 28V AC supplied from a 115V AC system through autotransformers. Control circuits and DC loads are supplied by transformer-rectifier units which convert three-phase AC power to 28V DC power. A small battery is used as an emergency or secondary source of emergency DC power. Circuit protection consists of current limiters as initial protection and circuit breakers on three panels located on the aft cockpit bulkhead for individual load protection. Heavy load items are protected by current limiters only.

POWER SYSTEM CONTROLS
All necessary control switches and indicators are on the engineer's upper panel except a bus selector switch located on the pilot's overhead control panel. Output from a generator is connected to a load bus when the associated generator line relay closes. Parallel operation of any combination of generators is accomplished when the associated bus tie relays and generator line relays are closed. The bus tie relays are interconnected by a synchronizing bus.

By proper use of the relays all generators will supply equal amounts of power to supply the total power demand. Normally all bus tie relays will be closed and parallel operation will result when the generator line relays close. Switches on the panel allow manual operation of generator relays, bus tie, generator line and generator field relays. Amber lights by each switch will indicate when a relay is not closed.

CONSTANT SPEED DRIVE
A constant speed drive is mounted on each engine's forward transfer gear box to convert varying engine speeds to a constant speed. The output from each constant speed drive (CSD) is supplied to the generator in form of torque on the generator rotor, thus providing a constant generator output frequency. The CSD is a hydraulic-mechanical system with an external oil supply and cooler. Speed is controlled by a basic speed governor with over and underspeed protection. When generators are operating in parallel, the CSDs are influenced by an equalizer system. Load controllers modulate the governors slightly to keep all generators at precisely the same RPM and in phase. This results in equal KW. An integral disconnect device enables disconnecting from the engineer's panel. This drive is able to maintain 6000 RPM at idle RPM of the engine and can give full generator output at any normal engine RPM. A drive malfunction light will indicate that CSD oil pressure is low. During engine start the CSD drive malfunction light will remain illuminated up to approximately 40% engine RPM. On engine shutdown, the CSD light will again illuminate as a normal function.

GENERATORS
Generators are engine-driven at 6000 RPM through the constant speed drive in order to maintain 400 cycles output. Each generator is controlled to 115V and protected against faults by a controller regulator.

Each generator is supplied DC field excitation current from separate static exciter units located on the rear spar inboard of engines 2 and 3. The static exciters are controlled by voltage regulators. Each generator contains a separate permanent magnet generator on the same shaft with the main generator rotor that supplies control power at all times the rotor is turning. When generators are operating in parallel, an equalizer system modulates the voltage regulator to obtain precisely the same voltage from each generator. This results in equal KVAR.

GENERATOR COOLING
Cooling air enters the generator from an air inlet duct on the left side of the engine cowl and exhausts it overboard on the right side of the engine. To aid the cooling when little or no blast air is available, special paddle-type fan blades are an integral part of the generator rotor.

OVERHEAT INDICATION
A red warning light for each generator system is on the engineer's upper panel. A gen. overheat light will warn when one of two thermal switches in the generator closes to indicate the generator temperature is above normal. At the same time, the master caution light on the captain's instrument panel will illuminate to warn the pilots when the generator overheat warning system has operated.

GENERATOR REGULATION
Generator voltage is maintained at the desired level by voltage regulators contained in the controller regulator. These units are located in an electrical equipment rack in the lower electrical compartment. This rack also contains the load controller for each generator and the four main transformer-rectifier units.

GENERATOR PROTECTION
If a generator system begins to produce abnormal voltage, or a generator feeder shorts to ground or to another feeder, the protective system will function and automatically turn the generator off. Both the field relay and the line relay will open if one of these faults occurs. If a serious load or phase unbalance occurs, the bus tie will open and take the bus out of parallel. If a sync bus fault occurs all bus ties will open, removing power from the sync bus and isolating generators to their own load busses. Individual relay lights will indicate which relays have opened.

AC POWER DISTRIBUTION

Primary Distribution
The main AC junction box on the aft wall of the electrical compartment is the location at which all AC power from the generators or external power cart first begin distribution. The generator line relays, bus tie relays and sync bus are located in this box. Initial current protection is also installed here to protect the wiring beyond this point. AC power is then supplied to five load busses located in the cockpit. The four main AC load busses are located in a box below the engineer's desk and the pilot's essential AC bus is located in a box below the circuit breaker panels. Current limiters at the busses protect some load items directly and also protect wiring supplying secondary load distribution. Load busses #1 and #4 are not essential and may be turned off and not affect the safety of the flight.

SECONDARY DISTRIBUTION
The secondary distribution consists of circuit breakers on three panels located on the aft cockpit bulkhead (Sta. 298). Circuit breakers on these panels protect the individual electrical loads. Circuit breakers powered from pilot's essential bus (or able to receive power from pilot's essential bus during the Electrical Fire procedure) are placarded "Pilot's Ess." Circuit breakers powered by the emergency DC bus are placarded "Emer" and further identified by stripes above the breakers. (A few so marked are not DC, but are able to receive power from an emergency 28 volt AC transformer during the electrical fire procedure.)

,ECTRICAL POWER SYSTEM

LOT'S ESSENTIAL POWER
ıe pilot's essential bus selector switch located on the overhead ntrol panel is a rotary switch with Gen 1 - Gen 2 - Ext Pwr - ·n 3 - Gen 4 positions. Any of these sources can be selected supply the Pilots' Essential AC bus by manual positioning of is switch. The selector will normally be selected to the Ext vr position where the power will come from the sync bus. With ɜ selector selected to a generator position, power will come rectly from the selected generator and opening the generator ıe relay will not interrupt power to the Pilot's Essential bus.

: POWER
: power is supplied by four 50 amp transformer-rectifiers -R's) which convert three phase AC power to 28 volt DC power. ıese 4 T-R's supply power to the two DC busses, Essential and nergency, which are normally tied together so that parallel ·R operation is possible. The busses are divided only when e battery is connected to the Emergency bus. The Emergency d Essential DC busses are located in a box below the circuit eaker panel. The battery is a reserve source of power for e Emergency bus and is connected to it by placing the battery ·itch to Emer. When the battery switch is in normal it is not ·nnected to the emergency bus, but is normally kept fully arged by a small T-R, which converts pilot's Essential AC ·wer to 32 to 35 volts DC power for charging purposes.

ıother small T-R converts External AC power to 28V DC to ·pply external power indicator lights and relay control power ıen external power is connected.

ΊERGENCY DC POWER
the event the Emergency DC bus has been deactivated, the ·ttery will supply power to some select circuits.

a loss of the Emergency DC bus occurs the battery transfer ·lay will be de-energized. With the essential radio switch on, e No. 1 VHF, PA, intercomm. and the Standby Horizon In- ·cator will be powered by the aircraft battery.

ıe evacuation alarm, emergency fuel shutoff valves and fire ·otection will transfer to the battery regardless of the position the essential radio switch.

KTERNAL POWER
escription
cternal 115/200V, three-phase AC power may be connected the two power receptacles and can supply power to servicing ·hts only or can be connected to the Sync bus and supply power all AC load busses or with power connected to the main recep- cle only, power can be supplied only to AC load busses No. 2 ıd No. 3 and pilot's essential. External power cannot be used parallel with the aircraft generators. The external power ansformer-rectifier is energized from the main receptacle ıly and is required to connect external power to the sync bus.

ıe external power control system contains an anti-cycle relay ıich prevents a surging or overloaded ground power unit from ·peatedly cycling on and off the bus by locking out on the first ·wn surge. The relay will then keep Ext power off until the ct Pwr switch or Ext Pwr unit is cycled off and back on.

cternal power relays control other circuits as follows:

Bus tie relay control power source is switched from emergency DC to external power when main external power relay is energized.

Service lights (Grnd Maint Lighting) are available when Ext Pwr is connected but external power relays are de-energized. (Uses different current limiters located at external power "J" box.) Service lights include cabin fluorescent lights and all 28V AC Essential lighting transformer circuits.

If only the main Ext Pwr relay is energized, load reduction relays will automatically open and kill load busses #1 and #4. Only load busses #2, #3, and pilot's essential bus can be powered by an external power unit having only one plug.

COCKPIT DOME LIGHTS
Two dome lights are located in the flight compartment ceiling aft of the pilots' overhead switch panel. Each dome light has a red and white bulb. A three-position compt lt, red-off-white, toggle switch on the overhead switch panel controls the lights.

A pushbutton thunderstorm switch is mounted in each pilot's control wheel. When pressed, these switches will illuminate the white dome lights regardless of the position of the toggle switch. When the thunderstorm switches are released, the dome lights will return to the illumination called for by the toggle switch position.

Operating power is 28V DC from the Emergency DC bus. Circuit protection is a circuit breaker C-7 Cockpit Dome Lts.

INSTRUMENT PANEL LIGHTS
The pilots' instrument panels are illuminated by red and white floodlights and high intensity fluorescent floodlights located in the glare shield above the instrument panel.

The red lights illuminating the first officer's flight instrument panel are controlled by a rheostat-type control (and replaceable fuse) located on the first officer's instrument panel.

The white floodlights, over all 3 panels, are controlled by a rheostat-type control located on the captain's aux panel and a fuse on the captain's instrument panel. This control also illuminates the fluorescent (high intensity) floodlights when the control is rotated to full bright.

Operating power for the white lights is Pilot's Ess bus and for the red lights is No. 3 bus. Three circuit breakers C-7 Inst Panel Lights (White and Red, Pilots First Officers), and one circuit breaker C-10 Inst Pnl Hi-Intensity Flood Lts.

COCKPIT LIGHTING

PILOT'S CONSOLE LIGHTS

The captain's and first officer's consoles are each internally illuminated by red lights in the console and controlled by a rheostat-type Console Lts control on each console.

Red floodlights are provided above each console. These lights are controlled by a three-position brt-off-dim toggle switch mounted on each console panel.

Power for console floodlights is from 28V A. C. Essential or Emergency transformers. Two circuit breakers, B-2 Console Flood Lts (Lh and Rh) power for console panel lights is from Pilot's Essential bus. Two circuit breakers C-7 Console Pnl Lts (Lh and Rh).

PILOTS' OVERHEAD SWITCH PANEL LIGHTS

Each section of the pilots' overhead switch panel is internally illuminated by red lights mounted on the panel.

A rheostat-type overhead panel lights control on the overhead switch panel varies the light intensity.

Power is from Pilots Essential bus C-7 Ped & Ovhd Pnl Lts.

PILOTS' PEDESTAL LIGHTS

Each section of the pilots' pedestal is internally illuminated by red lights mounted in the panel. The lights are controlled by a rheostat-type pedestal lights control located on the pilots' pedestal.

A red floodlight in the ceiling provides additional pedestal illumination, and one in the rear bulkhead provides additional overhead panel illumination. A three-position bright-off-dim toggle switch, Pedestal Flood, on the overhead switch panel controls the floodlights.

Power for pedestal panel lights is from Pilots Essential bus C-7 Ped & Ovhd Pnl Lts. Power for pedestal floodlights is 28V from Essential D. C. bus, B-1 Ped Flood & Lig Lts Ind Lts.

FLIGHT ENGINEER'S PANEL LIGHTS

Each section of the flight engineer's instrument panel is internally illuminated by red lights mounted in the panel. A rheostat-type flight engineers panel lights control (with integral fuse) located on the flight engineer's panel controls the light intensity.

Power is from Pilot's Essential bus C-7 Flt Engr Pnl Lts.

FLIGHT ENGINEER'S FLOODLIGHTS

Two ceiling flood lights, one red, one white also illuminate the flight engineer's panels. Two rheostat-type controls (with integral fuses) labeled engr's floodlight (red and white), are located on the aft side of the flight engineer's panel.

Power is from Pilot's Essential bus. C-7 Flt Engr Floodlight.

Flight Engineer's Circuit Breaker Floodlights and Utility Light.

A detachable utility light is mounted at the forward edge of the flight engineer's panel. This assembly includes a rheostat, red-white control and a momentary button switch. Three small floodlights illuminate the circuit breaker panel and current limiter panel areas. They are controlled by a switch on the aft side of the flight engineer's panel. Labeled circuit breaker floodlight.

Power for both circuits is from 28V Emer D. C. bus C-7 Flight Engr Utility Light.

MAP READING LIGHTS

Map reading lights are provided for the captain and first officer. The captain's map reading light is located to the left of the overhead switch panel and the first officer's light is to the right of the switch panel.

Each light has a built-in on-off toggle switch and light intensity control knob. Each light can be adjusted from a 14-inch diameter spot to a 2-inch diameter spot when directed on a map in the crew member's lap.

Power is from 28V A. C. essential lighting transformer. B-2 Map Reading Lts.

STANDBY COMPASS LIGHT

A red light is provided for the Magnetic Standby Compass on the glare shield. The rheostat-type standby compass light switch is located on the first officer's flight instrument panel.

Power is from 28V Emergency D. C. bus. C-7 Mag Comp Lt.

EXTERIOR LIGHTING

LANDING LIGHTS

Two inboard and two outboard landing lights are provided. The fixed position inboard landing lights are located in the leading edge of each wing, just outboard of the fuselage. The outboard landing lights are located in the lower outboard surface of each wing at the rear spar. These lights are retractable units that are flush with the wing when not in use.

The outboard landing lights use 1000-watt lamps and each light is controlled by a separate three-position extend-off-retract toggle switch. In the extend position the light will be extended by an A. C. electric motor and will be turned on only when the switch is in the extend position and the lamps are not fully retracted. The light can be extinguished in the extended position by placing the switch off. Amber warning lights above each switch will indicate that the lights are extended.

Operation power is 115V A. C. from the No. 2 bus. Circuit protection is supplied by two Outbd. Ldg. Lights circuit breakers (B-1). Indicator lights are powered from the Essential D. C. bus with circuit protection supplied by a Ped Flood & Ldg Lts circuit breaker (B-1).

XTERIOR LIGHTING
ıe inboard landing lights use 600-watt lamps and each light controlled by a separate on-off switch. Operating and control ıwer is 115V from the No. 3 bus. Circuit protection is supied by three Inbd. Ldg. Lights circuit breakers (B-1).

AXI LIGHTS
or taxiing purposes, two 250-watt lamps are located in the ading edge of each wing.

ıch light is controlled by a separate on-off switch located on e pilots' overhead switch panel.

perating power is 115V A.C. from the No. 2 bus, Circuit otection is a Taxi Lts circuit breaker (C-6).

ING ILLUMINATION LIGHTS
100-watt wing illumination light is installed on each side of e fuselage forward of the wing. These lights are used to tect ice formation on the wing leading edge.

wing ice lights on-off switch is located on the pilots' overad switch panel.

perating power is 28V A.C. from either the essential or the nergency lighting transformer. Circuit protection is a Wing e Lts circuit breaker (B-4).

OSITION LIGHTS
he position lights consist of a green light on the right wing p, a red light on the left wing tip and a white light on the aft p of the fuselage. Each wing position light incorporates two ght bulbs.

osition lights control is through a three position on-off-on att toggle switch. Operating power for the lights is supplied y the Emergency DC bus. When in the on position, control ower is from the Essential DC bus. When in the batt position, control power is from the Emergency DC bus.
ircuit protection is:

B1 - Pos Lts Cont - O/B Ldg Lt Ind - Ped Fld Lts.
B3 - w w Lts & Pos Lts Cont.
B3 - Pos Lts.

NTI-COLLISION LIGHTS
wo 40-watt anti-collision lights are provided, one on the upper ırface fo the fuselage and the other on the lower surface of the ıselage. These units are separately controlled and operated.

ach anti-collision light consists of two rotating lights operatd by an electric motor. The lights are controlled by switches n the pilots' overhead switch panel.

perating power is 115V A.C. from the No. 3 bus. Circuit rotection is supplied by two Anti-Col Lts circuit breakers 3-1).

OGO LIGHTS
wo flush mounted lights are installed in the upper surface f each horizontal stabilizer. The lights are controlled by a ingle switch on the pilot's overhead panel and when turned n will illuminate the TWA logo on the vertical fin.

perating power is supplied by the No. 4 bus. Circuit proection is provided by two Logo Lights circuit breakers (A-9).

CABIN LIGHTING

CABIN GENERAL LIGHTS
Indirect general illumination in the cabin is provided by 2 sets of fluorescent lights. Overhead lights are mounted on both sides of the ceiling and window lights are mounted just above the cabin windows. All the lights can be turned on or off by switches at either hostess panel or may be turned off by an override switch on the pilot's overhead switch panel. The window lights may be turned off separately by a switch on the aft hostess panel. The intensity of all lights may be controlled by a motor driven variable auto-transformer. The driving motor is controlled from either hostess panel by a brt-dim switch. The switch may be held to either position until desired light intensity is obtained.

Power is from No. 2 bus. Five circuit breakers C-6, Cabin Lights (Window - Lh & Rh, Ovhd - Lh & Rh, and Control).

8871: This aircraft has no window lights or variable dimming equipment. Dimming to a fixed degree is provided for the forward part of the cabin by a dimming switch on the forward hostess panel and for the aft cabin by a switch on the aft hostess panel. The point of division for dimming purposes is determined by a series of divide-normal switches along both sidewalls in approximately the center area of the cabin. On-off control remains the same as other 880's.

LOUNGE LIGHTS
The Lounge light switch type circuit breaker on the forward hostess panel controls 8 small lights in the ceiling at the forward end of the cabin.

Power is from 28V A.C. Essential lighting transformer. C-6 Stewardess Pnl, Fwd.

AISLE LIGHTS
Six aisle lights are installed in the cabin ceiling to illuminate the aisle between the passenger cabin seats. The aisle lights are controlled by two on-off toggle switches, one on each hostesses' control panel. These switches are wired in a three-way circuit to provide full operation from either panel.

Power is from 28V Emergency D.C. bus. B-2 Aisle Lts.

PASSENGER READING LIGHTS
The passenger reading lights are located in the underside of the hat racks, one above each passenger seat. Push button type switches are located adjacent to each light. An override switch, labeled pass. read, on the pilots overhead panel permits the removal of power to all the passenger reading lights. The lights are protected by five switch type circuit breakers on the aft hostess panel labeled Reading lights.

* * *

D. **CABIN LIGHTING**

4. Power is 28V A. C. from a reading light transformer through the 5 switch-type C. B. 's on aft hostess panel. Transformer power is from C. L. at the No. 4 bus. Transformer is controlled by the switch on the pilot's overhead switch panel using pilot's essential bus power. B-2 PILOTS OVERRIDE PASS LTS.

5. Passenger Entrance Lights

a. Two threshold lights and two overhead lights are located at each main passenger entrance. The lights are controlled by a switch in the corresponding main entrance door sill and are extinguished when the doors are closed and locked. This switch also controls the DOOR OPEN ABOVE FLOOR warning light in the flight compartment. The lights illuminate when the main entrance doors are opened. An override ENTRANCE, ON-OFF, switch-type circuit breaker is provided on the respective hostesses' control panel. Also located at each main entrance is a RAMP RECEPTACLE which is supplied with aircraft electrical power.

b. Power is 28V A. C. from essential lighting transformer. Two circuit breakers C-6 STEWARDESS PNL (FWD and AFT).

6. Coat Closet Lights

a. The forward and aft coat closets are each provided with an 8-watt fluorescent light controlled by a circuit breaker type ON-OFF switch located on the side of each coat closet.

b. Power is from No. 1 Bus. B-1 COAT CLOSET LTS.

7. Lavatory Lights

a. Three fluorescent lights in the forward lavatory are controlled by a switch on the forward hostesses' control panel. A lavatory door switch automatically extinguishes two of the three lights when the door is opened. Both aft lavatories have four fluorescent lights each, all controlled by a switch on the aft hostesses' control panel. Each aft lavatory door switch automatically extinguishes three of the lights when the respective door is opened.

b. Power is from No. 1 bus. B-1 LAV LTS.

8. Buffet Area Lights

a. Four lights are located in the ceiling of the forward buffet and two lights in the ceiling of the aft buffet. Switch-type circuit breakers on the hostesses' panel in their respective areas control the lights.

b. Power is 28V A. C. from Essential lighting transformer. Two C. B. 's on C-6 STEWARDESS PNL (AFT & FWD).

9. Cabin Attendants' Control Panel Lights

a. The hostesses' control panels are illuminated by integral red lights. A control switch, PANEL, ON-OFF, is located on each panel.

b. Power is 28V A. C. from Essential lighting transformer. Two C. B. 's C-6 STEWARDESS PNL (AFT & FWD).

E. **MISCELLANEOUS ELECTRICAL CIRCUITS/SYSTEMS**

1. Call System

a. When a cabin or lavatory call button is actuated, a light near the passenger illuminates, a light illuminates on each cabin control panel, and both chimes sound in the cabin. The location of the calling passenger is indicated by the light which illuminates on the hostesses' control panels. The chimes will sound again if the passenger again actuates his call switch; but the control panel lights and the passenger's light remain on until the push button switch is reset.

b. Pilots can call a hostess by pressing the STEW CALL button on the Interior Lights section of the overhead switch panel. Each time the button is pressed, the cabin chimes will sound and the light in the button will illuminate. In addition, if the PA/ Interphone handset is out of the holder when the button is pressed, red PILOT call lights at each hostess panel and in the cabin ceiling will illuminate and remain on until the cockpit handset is replaced in the holder.

c. Hostesses can initiate calls to the flight compartment by pressing a PILOT CALL button on either hostess PA control panel. The hostess call chime in the cockpit will sound and, while the button is pressed, a white CALL light on the overhead switch panel will be illuminated.

d. Hostesses can initiate calls to each other by lifting a PA/ Interphone handset from its holder and pressing the HOST CALL button at either PA control panel. The cabin chimes will sound and the STEW call lights on both hostess panels and in the cabin ceiling will illuminate and remain on until both handsets are replaced in their holders.

e. To speak into the public address system from one of the three handsets, the operator must actuate a PUSH PA light switch assembly after lifting the handset from the hook.

f. Handset hook switches automatically reconnect the handsets into the interphone system when the handsets are replaced on the hooks. This arrangement prevents accidental or unintentional talking over the public address system.

g. Power is from 28V Essential D. C. bus. Two C. B. 's, B-1 PASS CALL SYS (FWD & AFT).

2. Forward and Aft Cargo Compartment Lights

a. Three dome lights and one threshold light are located in each cargo compartment. The lights are controlled by automatic door switches, which also illuminate the DOOR OPEN BELOW FLOOR warning light in the flight compartment using other circuits.

b. Power is 28V A. C. Essential lighting transformer. Two C. B. 's B-6, AFT CARGO & TAIL COMPT LTS, and FWD CARGO COMPT LTS.

3. Electrical and Electronic Compartment Lights

a. Four lights provide illumination in the electrical and electronic compartment. The lights are controlled by the access door switch or an ON-OFF toggle switch adjacent to the inner surface of the in flight access door. This door also illuminates the DOOR OPEN BELOW FLOOR warning light.

b. Power is 28V A. C. from Essential lighting transformer. B-2 E & E COMPT LTS.

E. MISCELLANEOUS ELECTRICAL CIRCUITS/SYSTEMS

4. Air Conditioning Compartment Lights

a. Two lights are located in each of the forward and aft air conditioning compartments. The lights are controlled by automatic door switches.

b. Power is 28V A. C. from essential lighting transformer B-2 AIR COND & HYD COMPT LTS.

5. Wheel Well Lights

a. One light is located in each wheel well. These lights are connected to the position light circuit and are armed through the landing gear door "up" and "locked" warning switches. Thus the aircraft must be on the ground with position lights ON to illuminate the wheel well lights.

b. Power is from 28V Emergency D. C. bus B-3 W/W LTS AND POS LTS CONT.

6. Hydraulic and Pneumatic Compartment Light

a. One light, automatically controlled by the access door, illuminates the hydraulic and pneumatic compartment. This door is connected into the DOOR OPEN BELOW FLOOR warning light.

b. Power is 28V A. C. from Essential lighting transformer. B-2 AIR COND & HYD COMPT LTS.

7. Razor Power

a. Each lavatory has a power unit with two receptacles. One receptacle requires a special twist lock plug and supplies 28V D. C. for a special shaver carried by the hostess. The other receptacle is standard and supplies 115V D. C. and will operate most home-type shavers.

b. Operating power for the power units is from No. 1 bus. Circuit breaker is B-1 COAT CLOSET LTS.

8. Door Open Warning Lights

a. Two warning light assemblies on the first officer's aux instrument panel monitor the aircraft's doors. The upper light is labeled DOOR OPEN ABOVE FLOOR and monitors four doors; forward and aft passenger doors and forward and aft galley doors. The lower light is labeled DOOR OPEN BELOW FLOOR and monitors four doors; forward and aft cargo doors, electrical compartment door and hydraulic compartment door.

b. Power is from 28V EMER D. C. bus. B-2 DOOR OPEN WARN LTS.

9. Grnd Maint Lighting (Service Lts)
With external power connected, but external power switch OFF, busses are all dead. However, some lighting circuits are automatically selected away from their normal busses (and C/ L's) directly to external power C/ L's in the external power "J" box. These lights are then called "Service Lights" or "Grnd Maint Lights" and fall into one of two groups: Cabin General (fluorescent) lights and the 28V A. C. Essential (and thus Emergency) lighting transformer circuits. This includes all circuits listed as receiving power from these two transformers.

10. Spare Lamp and Fuse Box
A spare lamp and fuse stowage box is mounted on the flight compartment aft bulkhead. Spare lamps, two of each type used for the flight compartment lights, are stored in a shock-absorbing, foamed plastic retainer inside the box.

F. SUMMARY OF LIGHTING POWER SOURCES

The various aircraft lighting systems are supplied with electrical power from the following sources:

1. Pilots' A. C. Essential Bus:
   - Pilots' Instrument Panel and Floodlights
   - Pilots' Console Panel Lights
   - Pilots' Overhead Switch Panel Lights
   - Pedestal Panel Lights
   - Flight Engineer's Panel Lights and Floodlights

2. No. 1 A. C. Bus:
   - Coat Closet Lights
   - Lavatory Lights

3. No. 2 A. C. Bus:
   - Cabin General Lights
   - Outboard Landing Lights
   - Taxi Lights

4. No. 3 A. C. Bus:
   - Inboard Landing Lights
   - Anti-Collision Lights
   - Pilots Instrument Panel Red Lights

5. No. 4 A. C. Bus:
   - Passenger Reading Lights

6. 28V A. C. Essential Lighting Bus:
   - Map ReadingLights
   - Lounge Overhead Lights
   - Passenger Entrance Lights
   - Buffet Area Lights
   - Cabin Attendant Control Panel Lights
   - Forward and Aft Cargo Compartment Lights
   - Electrical and Electronic Compartment Lights
   - Air Conditioning Compartment Lights
   - Hydraulic and Pneumatic Compartment Lights
   - Aft Fuselage Lights

7. 28V A. C. Emergency Lighting Bus:
   - Console Floodlights
   - Wing Illumination Lights

8. 28V D. C. Battery Bus:
   - Emergency Lighting System (when power is not available from the 28V D. C. essential bus).

9. 28V D. C. Emergency Bus:
   - Standby Compass Lights
   - Aisle Lights
   - Wheel Well Lights
   - Position Lights

10. 28V D. C. Essential Bus:
   - Pilots' Overhead Switch Panel Floodlight
   - Pedestal Floodlight
   - Pylon Refuel Panel Lights
   - Passenger Loading Ramp Receptacles
   - Flight Compartment Dome Lights

G. WARNING LIGHTS

1. Master Caution Circuit

   a. When one of the aircraft systems connected to the MASTER CAUTION light malfunctions, the warning light associated with the malfunctioning system and the MASTER CAUTION light both illuminate. The pilot can extinguish and reset the MASTER CAUTION light by pressing it momentarily but the individual system warning light will remain on until the malfunction that caused it to illuminate is corrected. If another malfunction occurs in another system connected to the MASTER CAUTION light circuit, the MASTER CAUTION light will illuminate again and can be reset as before.

   b. Systems monitored by the MASTER CAUTION light are:

      (1) Generator overheat lights.
      (2) Engine fuel pump low pressure lights.
      (3) Start valve open lights.

2. Master and Warning Lights Dim Switch
   With the MASTER and WARNING LIGHTS switch on the overhead panel in the DIM position, all indicator lights with dimming relays including the MASTER CAUTION light will be dimmed.

3. Indicator Light Test Switch
   An indicator light test switch located on the Flight Engineer's panel tests all square indicator lights in the cockpit when placed to either the BRIGHT or DIM position.

* * *

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A. **HYDRAULIC PUMP OPERATION WITH INLET SUPPLY SHUTOFF VALVES CLOSED**

1. Operation of an engine-driven hydraulic pump with its' inlet supply valve closed should be avoided, due to the affect on mechanical components of the pump. Lack of fluid supply results in loss of lubrication and cooling flow through the pump, causing high pump case temperatures.

2. Any time that a pump is operated with its' supply valve closed, due to placing its' control switch to INLET CLOSED position or actuating the fire pull handle for the engine, an entry must be made in the aircraft log.

   The log entry should state the time, in minutes, that the pump was operated with its' supply valve closed and also state the operating condition of the engine at the time. Whether the engine was in a shutdown or windmilling configuration, rather than being operated in its' normal RPM range, will have a bearing on what subsequent maintenance action is necessary.

B. **SUPPLY PRESSURE LOW WARNING LIGHT ON IN FLIGHT**

1. If the SUPPLY PRESS LOW warning for a hydraulic system illuminates during flight, the following checks should be made to determine the affect of positive supply pressure loss.

   a. Check system fluid quantity as pressure loss could be result of ruptured supply line.

   b. Check system pressure for evidence of pressure fluctuation, due to pump cavitation.

   c. Check for system temperature within limits.

   d. Inboard pumps, due to shorter supply lines and lower relative position to the reservoir, may be more likely to provide stable system operation.

C. **ABNORMAL TRIM CHARACTERISTICS**

1. Before writing up a trim system, the aircraft should be flown and trimmed at normal cruise attitude and speed, noting the following:

   a. Fuel load unbalance

   b. Engine power settings. Cross check, using all engine instrumentation, to eliminate possible error in the basic power setting instrument (EPR).

   c. Manually assist the control being trimmed to find its' aerodynamic balance.

   d. Determine that spoiler speed brake lever is in its' DOWN detent position.

2. If the aircraft will not properly trim, after the foregoing checks, include the following information in the log book entry:

   a. Altitude, airspeed and mach number at time of trim check.

   b. EPR, RPM, EGT and fuel flow indications for all engines.

   c. All individual fuel tank quantity indications and also the indication on the fuel quantity totalizer.

   d. Complete IN FLIGHT TROUBLE SHOOTING REPORT (Form 139-757) carried in Crew Information Book holder. Place completed form in log book.

D. **LATERAL INSTABILITY AT HIGH MACH NUMBERS**

At Mach numbers above 0.84, lateral instability may be experienced due to one wing being affected more than the other by shock wave induced airflow separation. If wing heaviness develops, compensate by applying appropriate aileron trim correction. If this condition develops while using the auto pilot it will be reflected in the 3-axis trim indicator display. Disconnect the auto pilot, retrim the aircraft to the higher Mach number and re-engage the auto pilot.

E. **APPARENT JAMMED STABILIZER DUE TO FROZEN MOISTURE**

The stabilizer may, after exposure to cold temperature, show evidence of an apparent jammed condition due to improper lubrication and/or moisture present on the jackscrew or travel nut. This is evidenced by inability to operate the stabilizer by either normal or standby means. Although split-spoiler procedure will provide an immediate alternate means of trimming the aircraft, it is suggested that the normal and standby systems be periodically checked during descent into warmer temperatures. It is frequently possible that, when the frozen material is later thawed, entirely normal stabilizer operation will result.

F. **EN ROUTE OPERATION WITH LANDING GEAR DOWN**

1. When the landing gear cannot be raised following takeoff and flight continuance is desired, it must be determined that fuel on board will allow arrival at destination with required reserves. The following guidelines will assist in determining fuel requirements.

   a. At standard temperature, 25,000 feet, four engines maximum cruise thrust, gear down at 140,000 lbs. Gross Weight, TAS equals 325 KTS.

   b. Fuel flow for above conditions will be approximately 18,000 lbs/hr.

   c. In the event of subsequent engine failure, the aircraft will maintain 235 KTS IAS at 20,000 feet, three engines maximum continuous thrust, gear down and at 140,000 lbs.

   d. An increase in operating radius can be obtained if minimum practical speed is observed, rather than use of maximum available thrust, due to the substantially greater relative thrust requirement to maintain the higher speed.

G. **GEAR UNSAFE LIGHT ON AFTER GEAR RETRACTION**

When the gear unsafe light or the door warning light remains on after an otherwise normal retraction the problem is usually a malfunction of an uplock switch, a priority valve, or a sequence valve. Recycling the gear in most cases results in normal operation. If there is no obvious reason for either light remaining on, proceed as follows when circumstances permit:

1. Place the gear lever to neutral. The unsafe gear should free fall down and locked. When the green down and locked light comes on, the malfunctioning gear will be identified for corrective action by Maintenance. Note the light indications and proceed with step 2, whether or not there was a change in light indications.

2. Place the gear lever down. If the unsafe light or door warning light remains on when the gear is indicating down and locked, do not retract the gear.

AR UNSAFE LIGHT ON AFTER GEAR RETRACTION

f all gear are indicating down and locked, and the nsafe light and door warning light are out, retract he gear.

f the gear unsafe light or door warning light again emains on after retraction, do not recycle the gear.

NTI-SKID SYSTEM FAULT

efore Takeoff

lain gear anti-skid protection must be functioning for ispatch, however, see Inoperative Equipment List, hapter 15.50 of this handbook for system components hich may be inoperative. If the nose brake anti-skid ystem is inoperative, see Chapter 15.50 for dispatch equirements.

efore Landing

. If one or more release lights fail to come on when the gear is extended, leave the anti-skid switch ON. Apply brakes cautiously to prevent skidding the affected wheel(s).

. If the main anti-skid inoperative light is on, check that main and nose anti-skid circuit breakers are set and recycle the anti-skid switch. If the light stays on, leave the anti-skid switch ON and use manual braking technique on landing.

. If the nose anti-skid inoperative light is on, the nose brakes will be inoperative. Do not pull the nose anti-skid control circuit breaker to deactivate the nose brakes because the 7 second locked wheel protection and 3 second fail safe features of the main brake anti-skid system are powered through the nose anti-skid control circuit breaker.

fter Landing

f the brakes fail on landing or during other ground operation, urn the anti-skid switch OFF to restore manual braking.

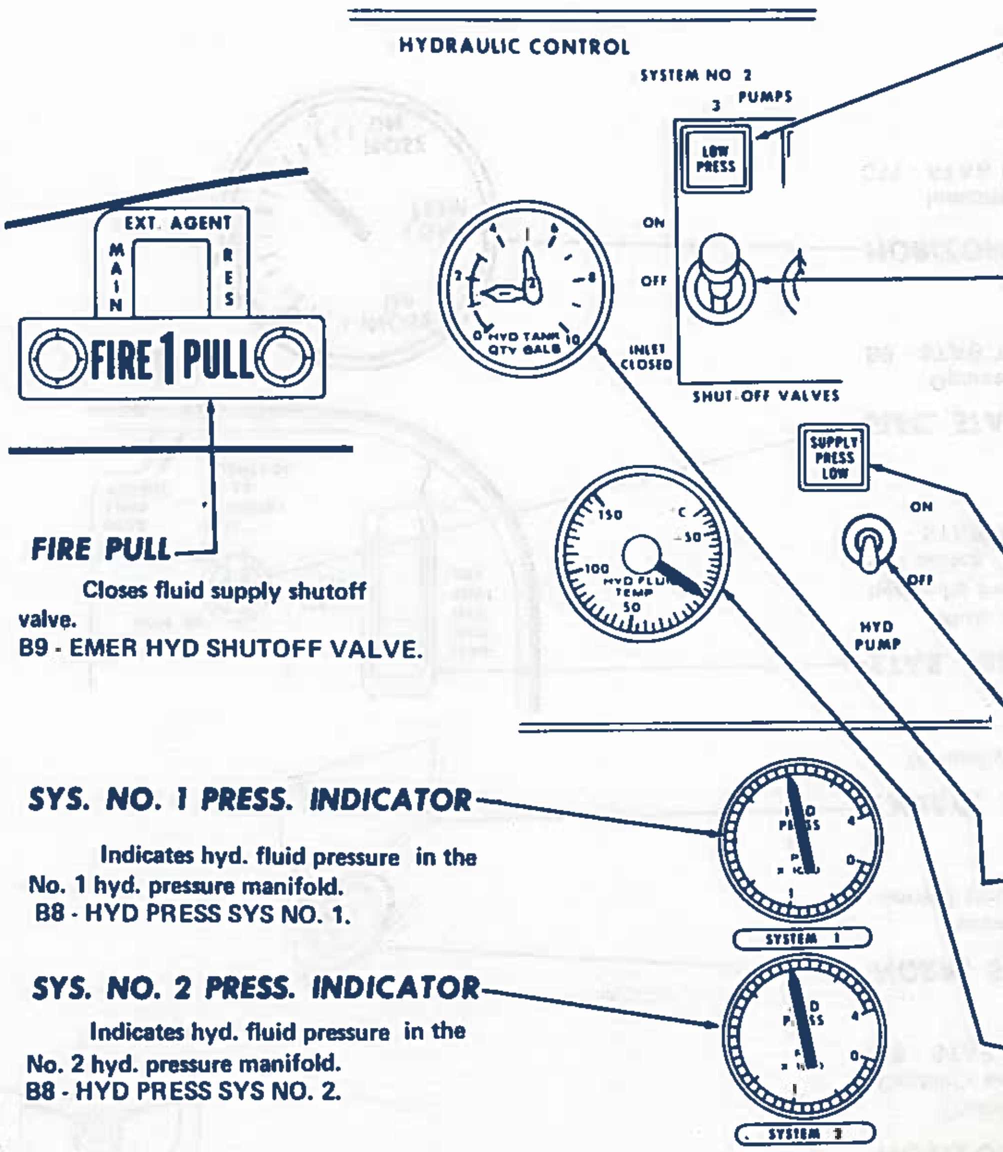
SYMMETRICAL WING FLAPS

Vhen flap operation has stopped due to an asymmetrical ondition, the flap handle should be repositioned to the ctual position of the failed flap. This will prevent ncreasing the asymmetrical condition if electrical power o the flap shutoff valves is subsequently lost.

efer to No Flap Procedure, Chapter 03.12, to determine lug speed with partial flaps.

* * *

A. HYDRAULIC POWER CONTROL



ENG. PUMP LOW-PRESS. LIGHT

Indicates respective engine pump pressure is low. (Light deactivated when "FIRE PULL" is PULLED or when pump control switch is "OFF".)
B8 - HYD PRESS LOW WARN.

ENG. PUMP CONTROL SWITCH

ON - Allows normal pump output pressure.
OFF - Energizes solenoid valve to depressurize pump.
INLET CLOSED - Depressurizes pump and closes supply shutoff valve. Logbook notation required.
B9 - EMER HYD SHUTOFF VALVE.

SUPPLY PRESS. LOW LIGHT

Indicates low pressure in supply manifold.
B8 - HYD TEMP & RETURN PRESS WARN.

AUX. PUMP CONTROL SWITCH

When "ON", operates Aux. Hyd. pump motor and opens Hyd. reservoir interconnect.
B9 - HYD PUMP MOTOR CONT.

FLUID QUANTITY INDICATOR

Indicates fluid quantity above zero reference level in each reservoir.
B9 - HYD FLUID QTY IND.

TEMP. INDICATOR

Indicates temperature of fluid in supply manifold.
B8 - HYD TEMP & RETURN PRESS WARN.

FIRE PULL

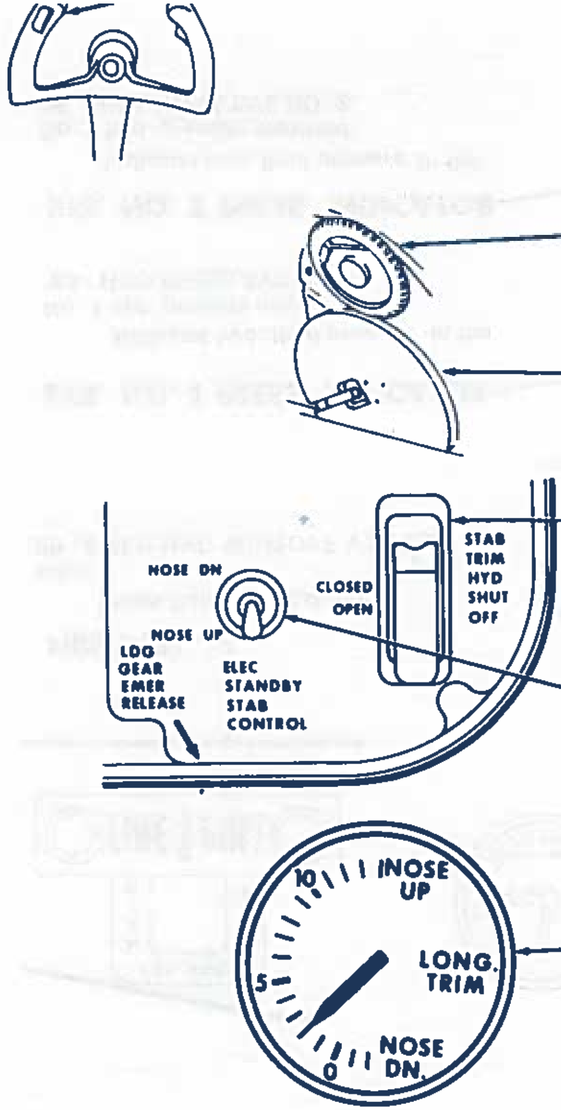
Closes fluid supply shutoff valve.
B9 - EMER HYD SHUTOFF VALVE.

SYS. NO. 1 PRESS. INDICATOR

Indicates hyd. fluid pressure in the No. 1 hyd. pressure manifold.
B8 - HYD PRESS SYS NO. 1.

SYS. NO. 2 PRESS. INDICATOR

Indicates hyd. fluid pressure in the No. 2 hyd. pressure manifold.
B8 - HYD PRESS SYS NO. 2.



HORIZONTAL STAB. CONTROL SWITCHES

Provides electrical control of normal trim system. Captain's switch has priority over first officer's.
B9 - STAB TRIM CONT.

NORM. STAB. TRIM WHEEL

Provides manual control of hydraulically operated normal trim system.

EMERG. STAB.TRIM WHEEL

Manually operates the standby trim system.

STAB. TRIM HYD. SHUTOFF SWITCH

Shuts off hydraulic pressure to normal trim system hydraulic motor and arms the standby trim system control switch.
B9 - STAB TRIM CONT EMERG.

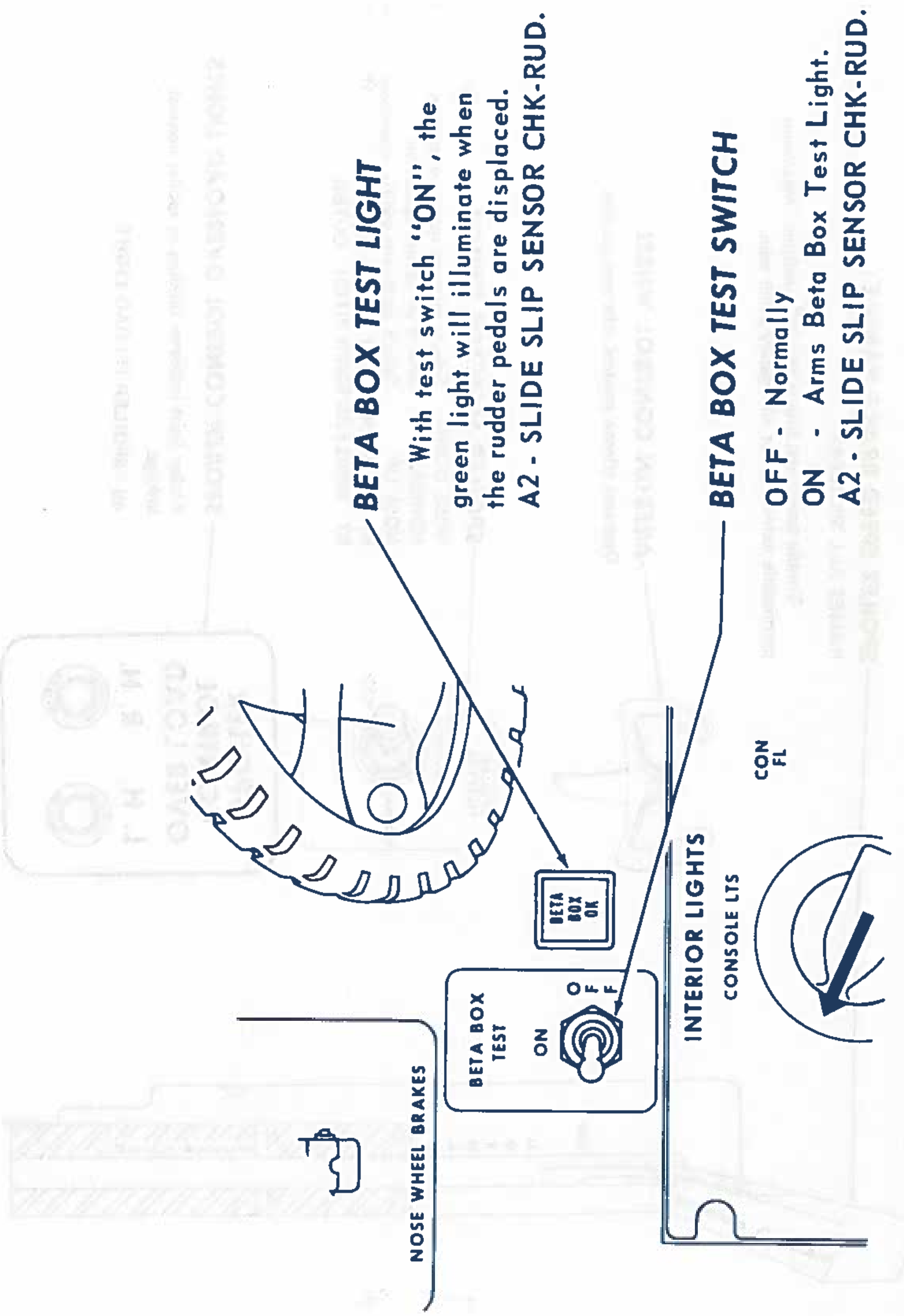
ELEC. STANDBY STAB. CONTROL SWITCH

Operates the standby trim system electrically.
B9 - STAB TRIM CONT EMERG.

HORIZONTAL STAB. POSITION IND.

Indicates true position of horizontal stabilizer.
C11 - STAB POS IND.

C. BETA BOX TEST



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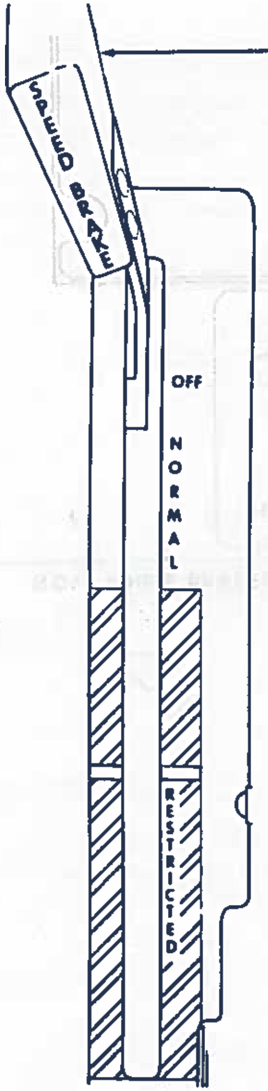


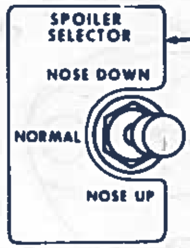
SPOILER SPEED BRAKE HANDLE

RAISES ALL SPOILERS

Double horizontal line is the 40° position. Maximum permissible extension for emergency pitch trim.

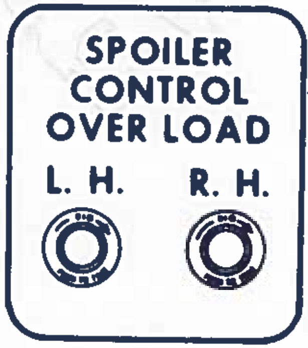
AILERON CONTROL WHEEL

Operates aileron control tabs and spoilers.



SPOILER SELECTOR SWITCH

NOSE DOWN - Selects inboard spoiler operation.
NORMAL - Selects all spoiler operation.
NOSE UP - Selects outboard spoiler operation.
B7 - SPOILERS EMER PITCH - INBD.
B7 - SPOILERS EMER PITCH - OUTBD.

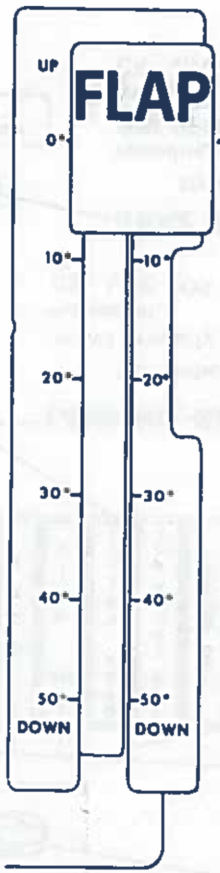


SPOILER CONTROL OVERLOAD LIGHTS

Amber light indicates binding in spoiler control linkage.

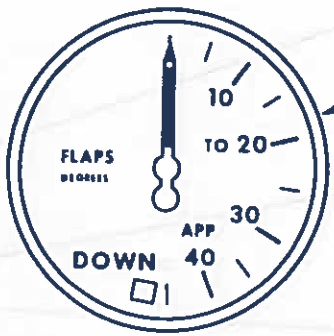
A9 - SPOILER O'LOAD LIGHT.

E. FLAPS



FLAP CONTROL HANDLE

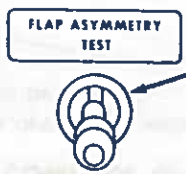
Preselects flap position by opening the control valve - flap follow-up closes control valve. Detent positions are 20° - 30° - 40° - 50° - Intermittent warning horn will sound when on the ground, if any two throttles are advanced and flaps are not in the takeoff position. Steady warning horn will also sound in flight, if the flaps are lowered beyond 35° and any one or more gear are not locked down. As the flaps are lower beyond 35°, the outboard spoilers begin coming up to a maximum of 8 degrees.



FLAP POSITION INDICATOR

The wing flap position indicator is a dual-reading indicator. The exposed pointer indicates position of left-hand flaps. The hidden pointer indicates position of right-hand flaps.

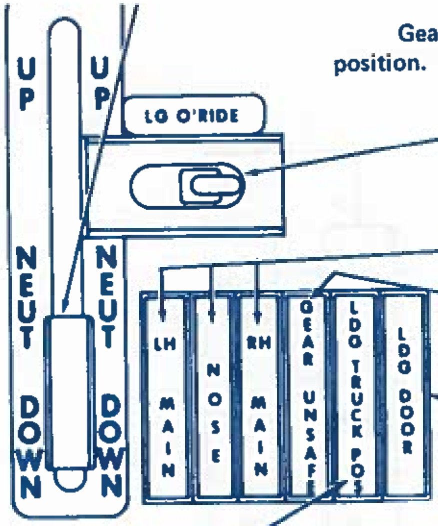
C8 - FLAP POS IND.



FLAP ASYMMETRY TEST SWITCH

TEST - Electrically closes the two spring-loaded flap shutoff valves. Does not test the flap asymmetry switches.

C8 - FLAP ASYM CONT.



Gear lever has detents for each position. To release, pull aft.

LANDING GEAR OVERRIDE RELEASE

Moving lever left disengages locking pin from gear lever linkage, permitting emergency gear retraction.

LANDING GEAR DOWN & LOCKED LIGHTS

Green lights indicate related gear is down and locked.
C8 - LDG POS & WARN.

LANDING GEAR UNSAFE LIGHT

The red gear unsafe light indicates one or more of the following conditions exists:

a. Gear lever is out of down detent with gear extended.
b. Any gear is unlocked.
c. Main gear is locked down and nose gear locked up.
d. Override release is in override position (ground).
e. Right MLG safety switch not in air position when aircraft is airborne.

28V DC BATT BUS.

LANDING GEAR TRUCK POSITION LIGHT

The amber light indicates MLG truck is not properly positioned for gear retraction.
C8 - LDG POS & WARN.

LANDING GEAR DOOR WARNING LIGHT

Red light indicates:

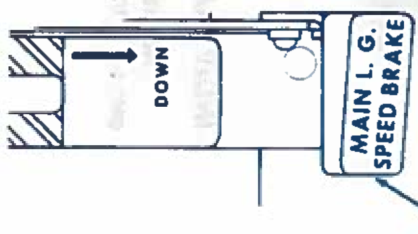
a. One or both MLG doors are not closed and locked.
b. Nose gear doors are not closed and locked when the nose gear is up and locked. (NLG doors are not in the door light circuit until the nose gear is up and locked.)

C8 - LDG POS & WARN.

GEAR WARNING HORN CUTOFF

Momentarily depress to silence horn if sounding due to any throttle retarded under 80% RPM and any gear not down and locked.
C8 - WARN HORN.

G. MLG DRAG BRAKE LEVER AND MANUAL EXTENSION LEVERS



MLG DRAG BRAKE LEVER

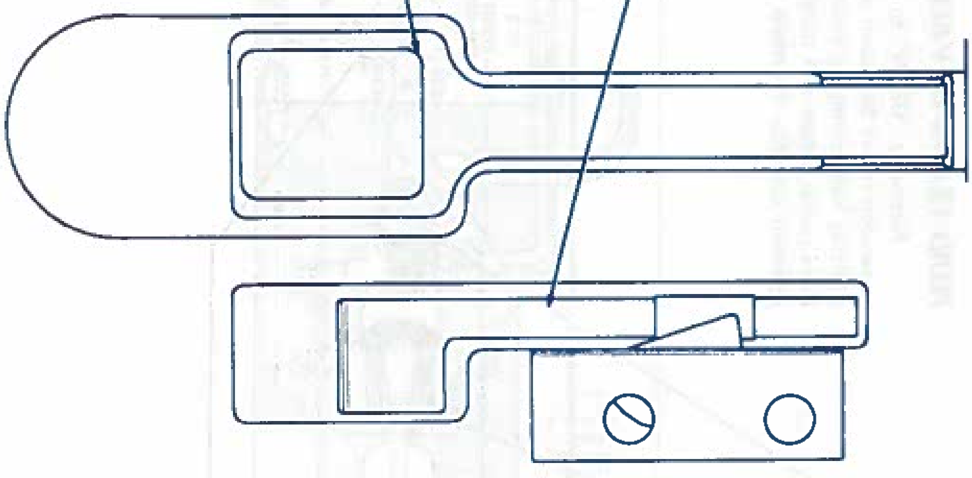
NORMAL - Allows normal operation of gear with Landing Gear Control Lever.

DOWN - Extends MLG only.

Mechanical interlock between gear lever and drag brake lever prevents:

a. Movement of gear lever when drag brake lever is not in NORMAL detent.

b. Movement of drag brake lever when gear lever is not in NEUTRAL.



NLG MANUAL EXTENSION LEVER

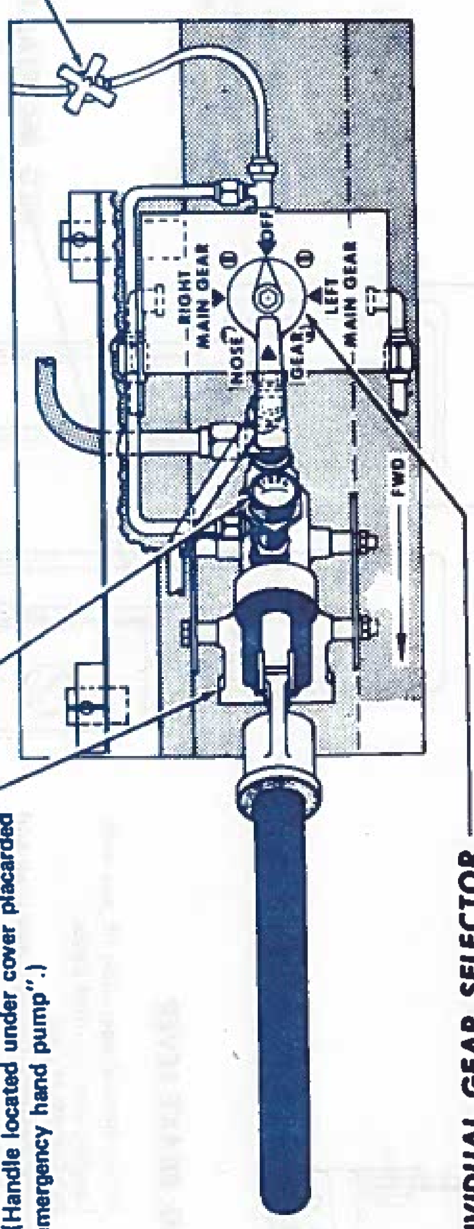
Mechanically unlocks the NLG door and the NLG, so it may free fall down and lock.

MLG MANUAL EXTENSION LEVER

Mechanically allows air pressure from the MLG accumulator to unlock and open the doors. Mechanically unlocks the MLG uplock and allows it to free fall down and lock. The MLG doors will remain open.

(4276)

SUPPLEMENTAL EXTENSION SYSTEM (HAND PUMP AND SELECTOR VALVE)



FLUID TRANSFER VALVE

Normally "OPEN" to allow a path for thermal expansion (must be closed and remain closed when utilizing hand pump to extend gear). If valve is open, hand pump action will transfer fluid from supplemental reservoir into No. 1 system reservoir.

PRESSURE INDICATOR

Indicates line pressure developed by hand pump.

EMERG. HAND PUMP

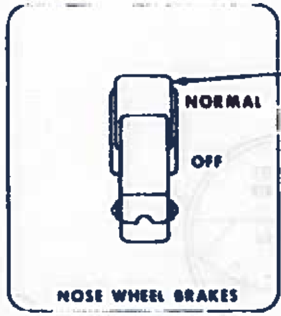
(Handle located under cover placarded "LG emergency hand pump".)

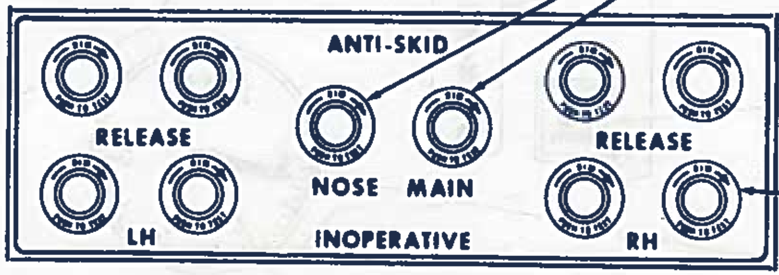
INDIVIDUAL GEAR SELECTOR

Normal "OFF" (select desired gear prior to pumping).

(4289)

I. NORM BRAKE PRESS AND ANTI-SKID





NOSE WHEEL BRAKES SWITCH

NORMAL — Provides power for NLG brake anti-skid operation.

OFF — Deactivates NLG brakes

C8 ANTI-SKID CONT

BRAKE PRESSURE INDICATOR

Indicates hydraulic pressure available to the MLG brakes. The transmitter is connected to the fluid side of the brake accumulator.

A3 NORMAL POWER IS 28 V AC ESS LIGHT TRANSFORMER.
ALTERNATE POWER FROM EMER STATIC IGNITION INVERTER.

MLG ANTI-SKID SWITCH

ON - Provides power for MLG brake anti-skid operation.

OFF - Deactivates MLG anti-skid system.

C8 - ANTI-SKID CONT.

NLG ANTI-SKID INOPERATIVE LIGHT

(AMBER LIGHT) Indicates NLG brakes are inoperative.

C8 ANTI-SKID CONT

MLG ANTI-SKID INOPERATIVE LIGHT

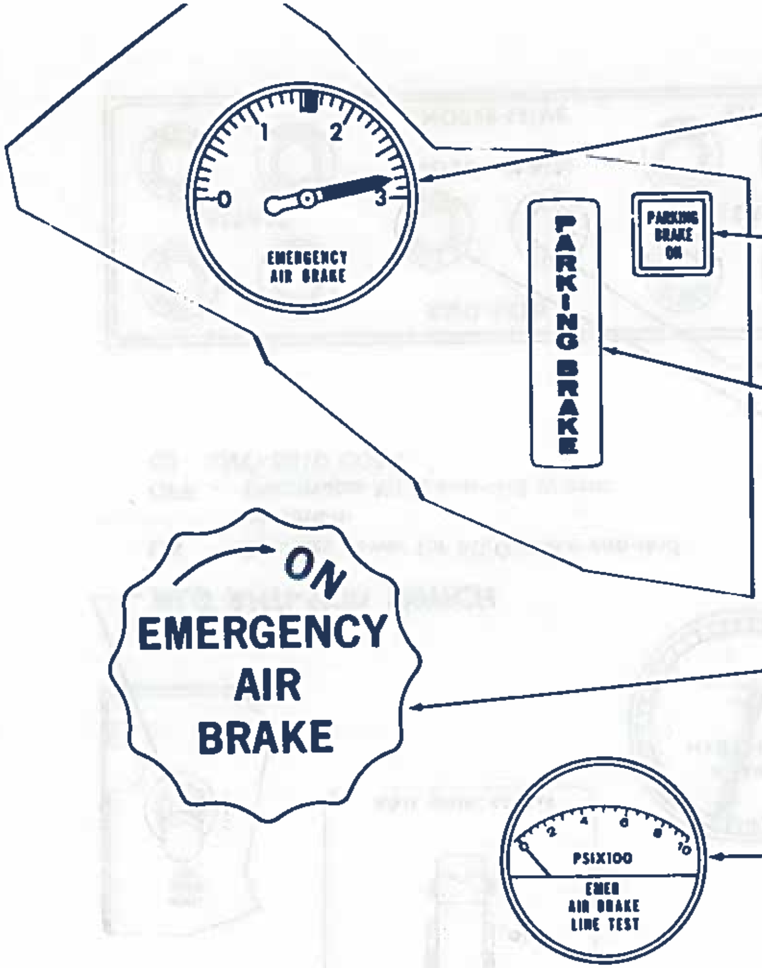
(AMBER LIGHT) Indicates anti-skid protection has has been lost to one or more main landing gear brakes.

C8 ANTI SKID CONT.

MLG ANTI-SKID RELEASE LIGHTS

(AMBER LIGHT) Indicates the related brake is released.

C8 ANTI-SKID CONT



EMERG. BRAKE BOTTLE PRESS. INDICATOR

Indicates pressure in emergency brake air bottle. Direct reading.

PARKING BRAKE LIGHT

ON - Indicate parking brake mechanically set.
C5 - PARKING BRAKE WARN LT.

PARKING BRAKE HANDLE

With both pedals depressed will set parking brakes - Hydraulic pressure required to actuate brakes. Either Pilot may release by depressing toe pedals.

EMERG. BRAKE CONTROL

Clockwise rotation meters emergency air brake pressure to MLG brakes. No anti-skid protection.

EMERG. BRAKE LINE PRESS. INDICATOR

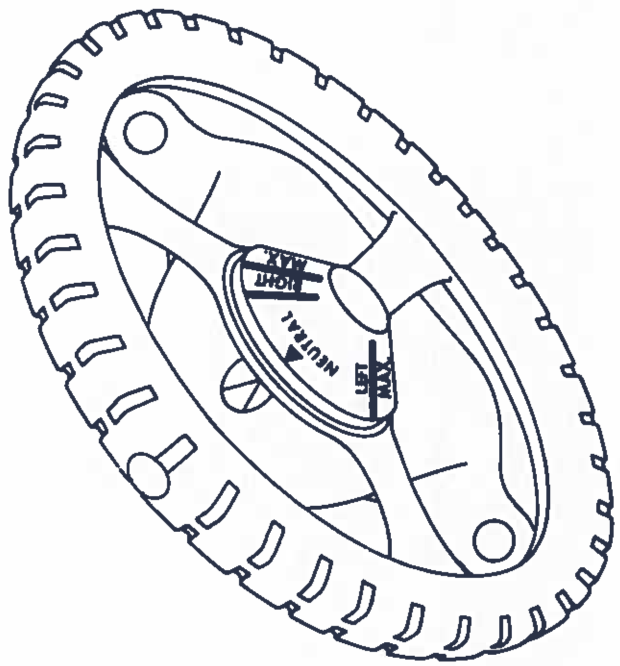
Indicates emergency air brake pressure being applied to MLG brakes. Direct reading.

(4234)

K. STEERING

NOSE GEAR STEERING WHEEL

Wheel is centered when rivet is on top. Maximum nose wheel turn angle is 70°, but recommended not to exceed the 56° index line. NLG brakes deactivated if nose wheel turns beyond 5° of center.



A. INTERCONNECT LINE SHUTOFF VALVE

An electric motor driven shutoff valve is installed in the hydraulic reservoir interconnect line at the #1 reservoir, replacing the present interconnect line free-flow restrictor type check valve.

This shutoff valve is for the purpose of preventing contamination interflow between #1 and #2 hydraulic systems when only one system is affected, and to prevent fluid loss from both system reservoirs should a leak develop in either system.

The shutoff valve is normally CLOSED, but will OPEN when the aux hydraulic pump switch at the Engineer's station is placed to the ON position. Electric power is 28V D.C. essential bus HYD RSVR INTERCONNECT VALVE B-4.

A guarded two-position OPEN-CLOSED toggle switch is located on the rear bulkhead in the hydraulic compartment, near the ceiling and approximately 16 inches to the right of aircraft centerline. This switch will OPEN the shutoff valve.

The shutoff valve has a RED indicator lever which provides visual reference to valve position, and corresponding OPEN-CLSD raised lettering on the end of the valve motor. The valve is installed in such a manner that when the valve is in the CLSD position the RED indicator is in a vertical position with reference to the aircraft. When the valve is in the OPEN position the RED lever will be out of sight, having moved in a counter-clockwise direction as viewed from the hydraulic compartment entrance door.

NOTE

The reservoir interconnect shutoff valve modification replaces the aux. pump control switch with one that does not magnetically hold the switch to the ON position, therefore, the switch will not return to the OFF position when power is removed from the aircraft. Have aux. pump switch in the OFF position before applying electrical power to the aircraft.

B. HYDRAULIC SYSTEM RETURN FILTERS

A bypass type filter is installed in the #1 and #2 hydraulic system return lines. The filters are bracket mounted in the hydraulic compartment. The #1 filter is located near the floor of the area approximately below the #1 hydraulic reservoir, while the #2 filter is mounted near the ceiling of the compartment adjacent to the top aft corner of the hydraulic equipment panel.

These filters are for the purpose of reducing the contamination level in the hydraulic systems.

C. HYDRAULIC RESERVOIR MAGNETIC CHIP DETECTORS

Magnetic plugs are installed in the drain ports of #1 and #2 hydraulic system reservoirs.

Contamination has been found in the fluid in the hydraulic reservoirs in the form of fine steel particles which can pass the reservoir screen. The addition of the magnetic plugs will trap these particles and prevent their re-entry into the hydraulic supply system.

D. WING FLAP ASYMMETRY TEST SWITCH

A locked OFF, momentary ON switch for testing the operation of the solenoid operated flap shutoff valves is located adjacent to the turn and bank indicator on the First Officer's instrument panel.

When the switch is placed to the TEST position the test circuit bypasses the asymmetry detectors energizing the flap asymmetry control relay. This energizes both flap shutoff valves, stopping flap operation.

To functionally test the opening and closing of the wing flap shutoff valves.

1. Place switch to TEST position while flaps are in motion and note that both pointers on dual flap position indicator stop.
2. Return test switch to normal and note flaps move to selected position. Electrical power is 28V D.C. ESS. Bus with 5A C.B. FLAP ASYM. CONT. C-8.

E. FLAP NULL SWITCH CIRCUIT

A null switch and flap position control relay have been installed to close the flap shutoff valves, thereby blocking all fluid pressure to the control valve, when the valve is in neutral.

F. ANTI-SKID BRAKE SYSTEM - WITH INDIVIDUAL MLG BRAKE RELEASE LIGHTS

1. General

   The brake system principle of operation remains unchanged with the installation of the MLG individual anti-skid release lights. All indicator lights have been changed to the push to test and rotate to dim type installed on the anti-skid control panel, with four release lights on each side of the inoperative lights. Each release light is connected to its respective anti-skid control valve solenoid.

2. System Operation

   a. The amber INOPERATIVE lights for the NLG and MLG will continue to illuminate whenever there is a fault in the unit controlling the respective anti-skid system.

   b. An amber RELEASE light when illuminated indicates that the skid control valve solenoid is energized for that wheel This will occur under the following conditions:

      (1) With aircraft on the ground, if a skid signal is received on any wheel and the skid control valve solenoid is energized, the releated RELEASE light will illuminate until power is removed from the solenoid. If a continuous skid signal of 3 seconds or longer should occur the related release light will go out and the MLG INOPERATIVE light will illuminate, indicating that the anti-skid system is inoperative for the brake or brakes that had been releasing and that manual braking is available to the effected brakes.

      (2) With aircraft airborne, gear down and locked and anti-skid switch ON all eight release lights should be illuminated indicating that the MLG brakes are released. The INOPERATIVE lights should be out, indicating that the anti-skid system is operative.

      During night operation it is desirable to dim all anti-skid lights prior to gear extension. This will prevent flooding the cockpit with yellow light.

F. ANTI-SKID BRAKE SYSTEM - WITH INDIVIDUAL MLG BRAKE RELEASE LIGHTS

On touchdown all eight lights will go out and only illuminate if the anti-skid system senses an impending skid.

G. SURGE DAMPENER IN MAIN GEAR PRESSURE LINE

A small accumulator is installed in the main landing gear pressure line between the priority valve and the main gear selector. It is located adjacent to the No. 1 system accumulator, just forward of the compartment access door.

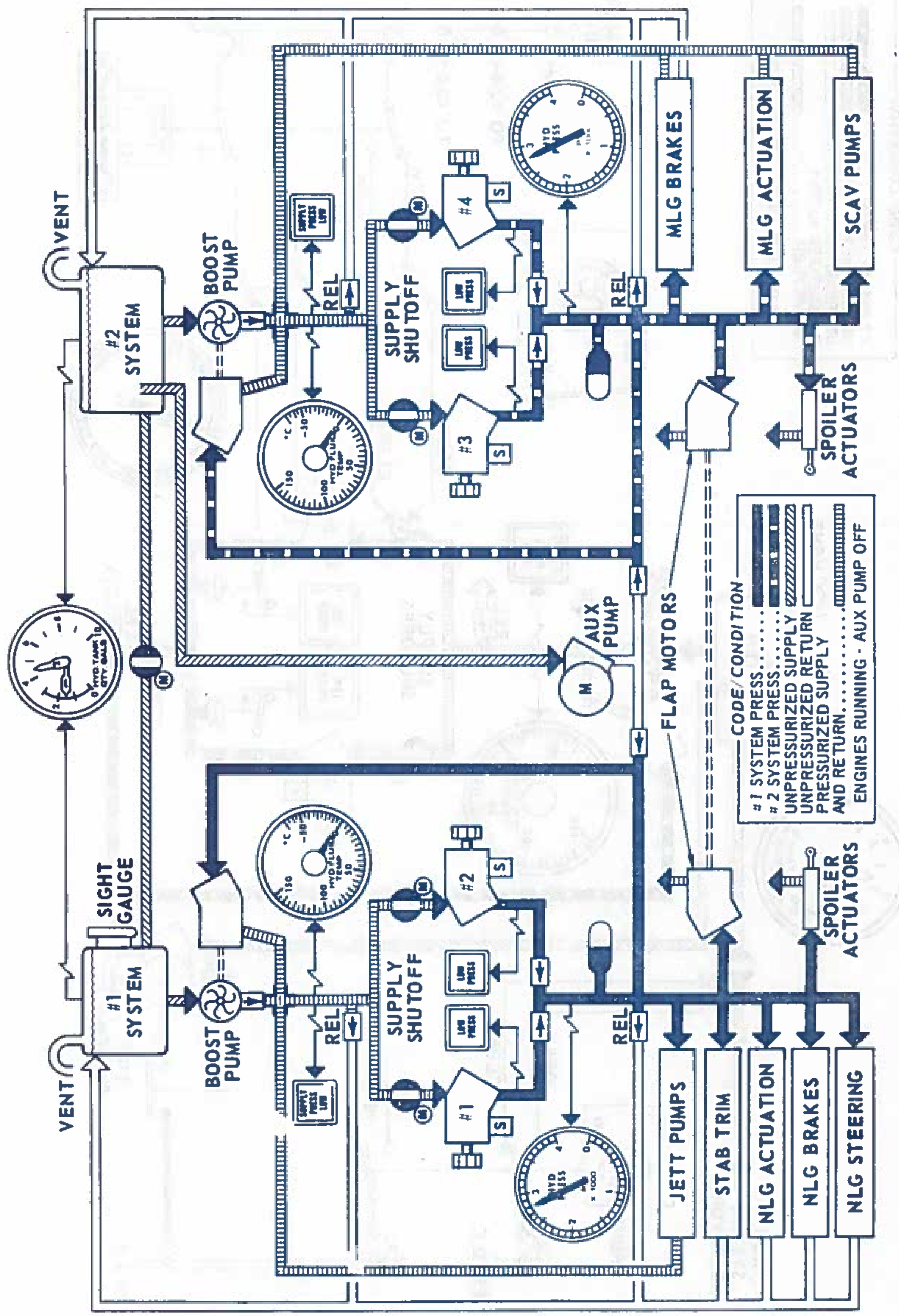
When serviced with a 500 PSI air charge, the added accumulator acts as a surge dampener protecting main gear pressure lines and components from high pressure surges during normal gear operation.

The surge dampener accumulator pressure gauge will normally indicate pressure identical to that in the main landing gear accumulator. A check of its air charge can be made, as in the case of the main landing gear accumulator, only after completely depressurizing the portion of the landing gear/ brake systems normally retaining pressure due to the main gear isolation check valve.

Installation of the surge dampener does not change any operating procedures or affect gear operation except to improve system reliability.

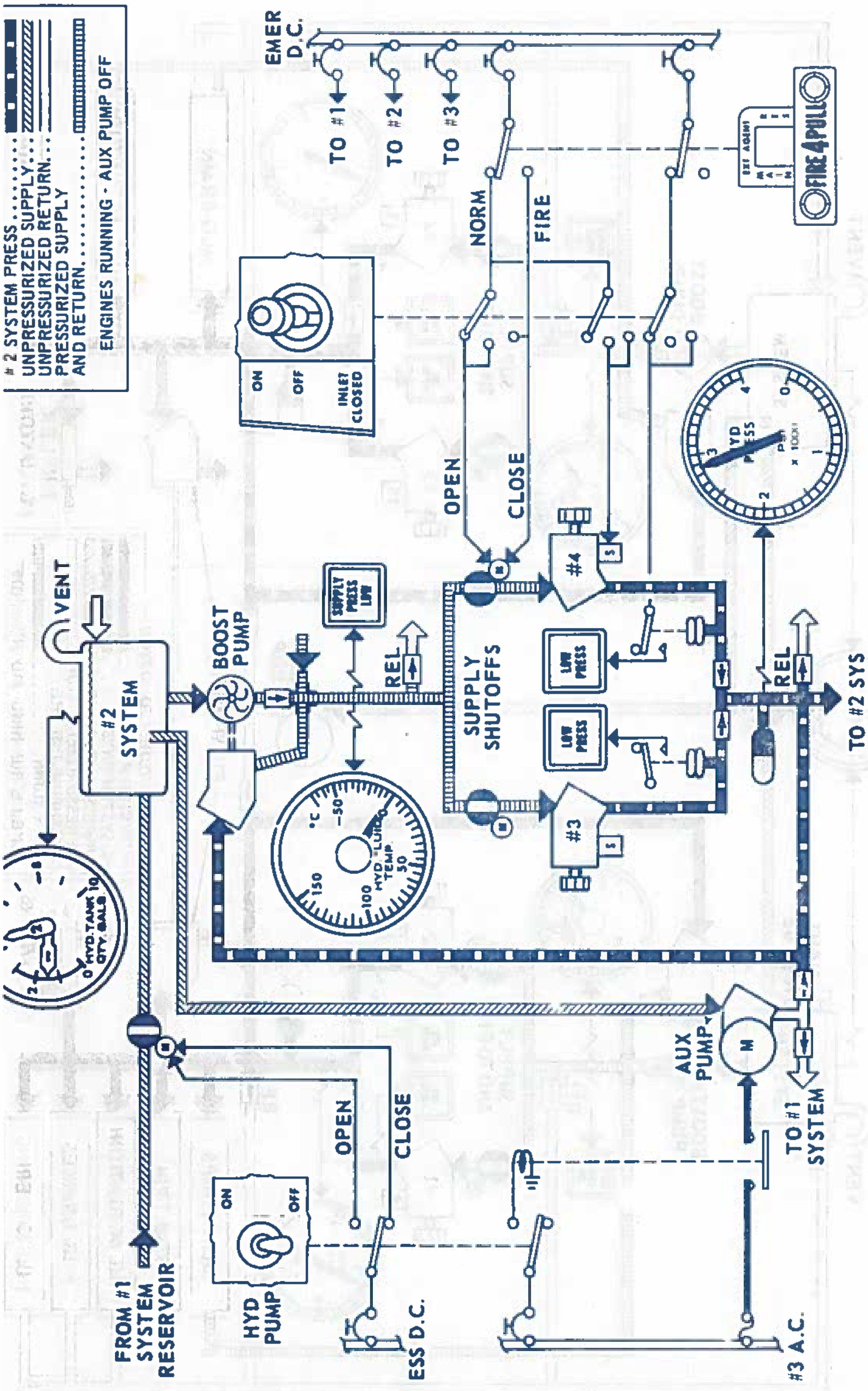
* * *

A. HYDRAULIC POWER SYSTEM



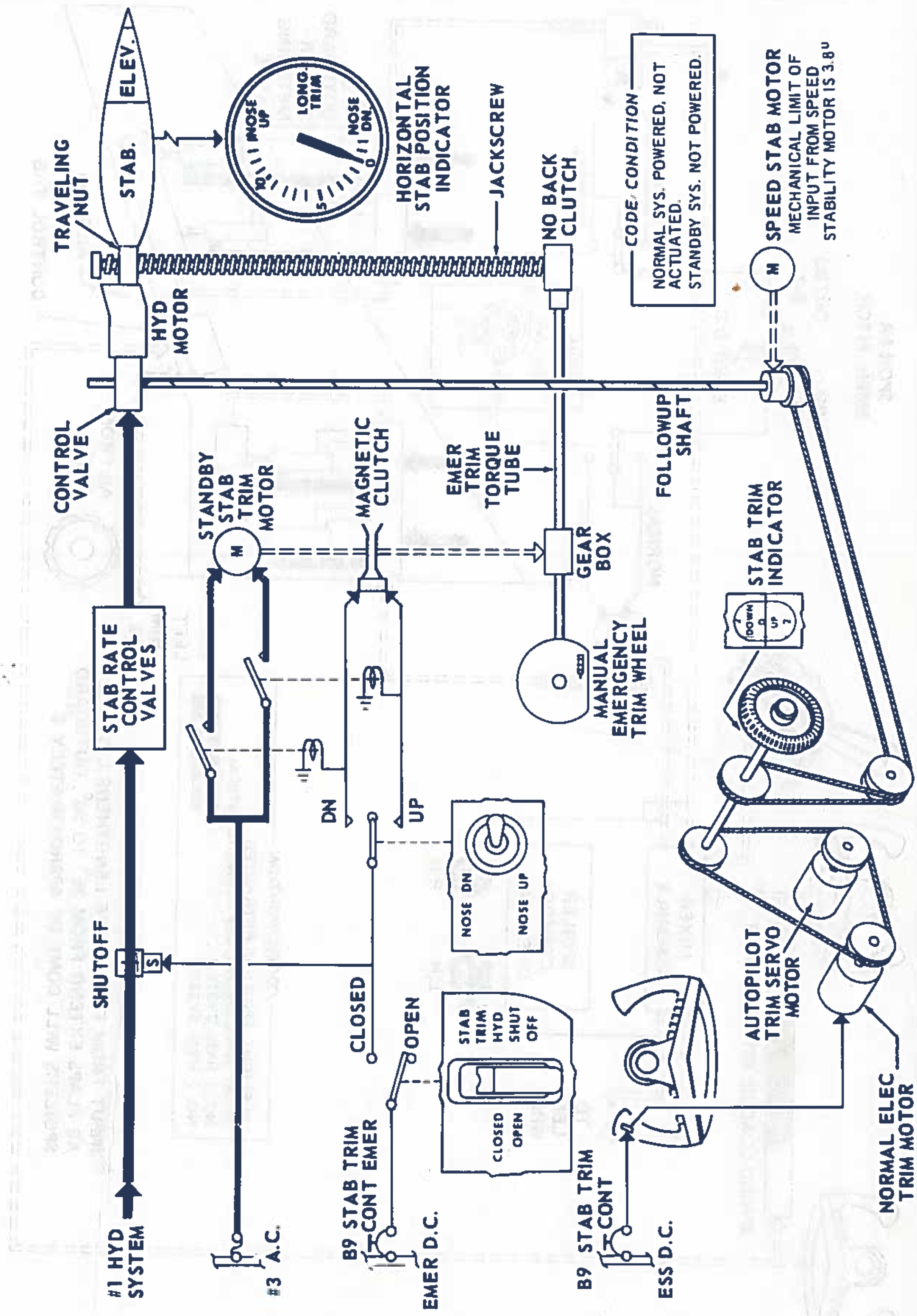
(4168)

HYDRAULIC POWER SYSTEM CONTROL



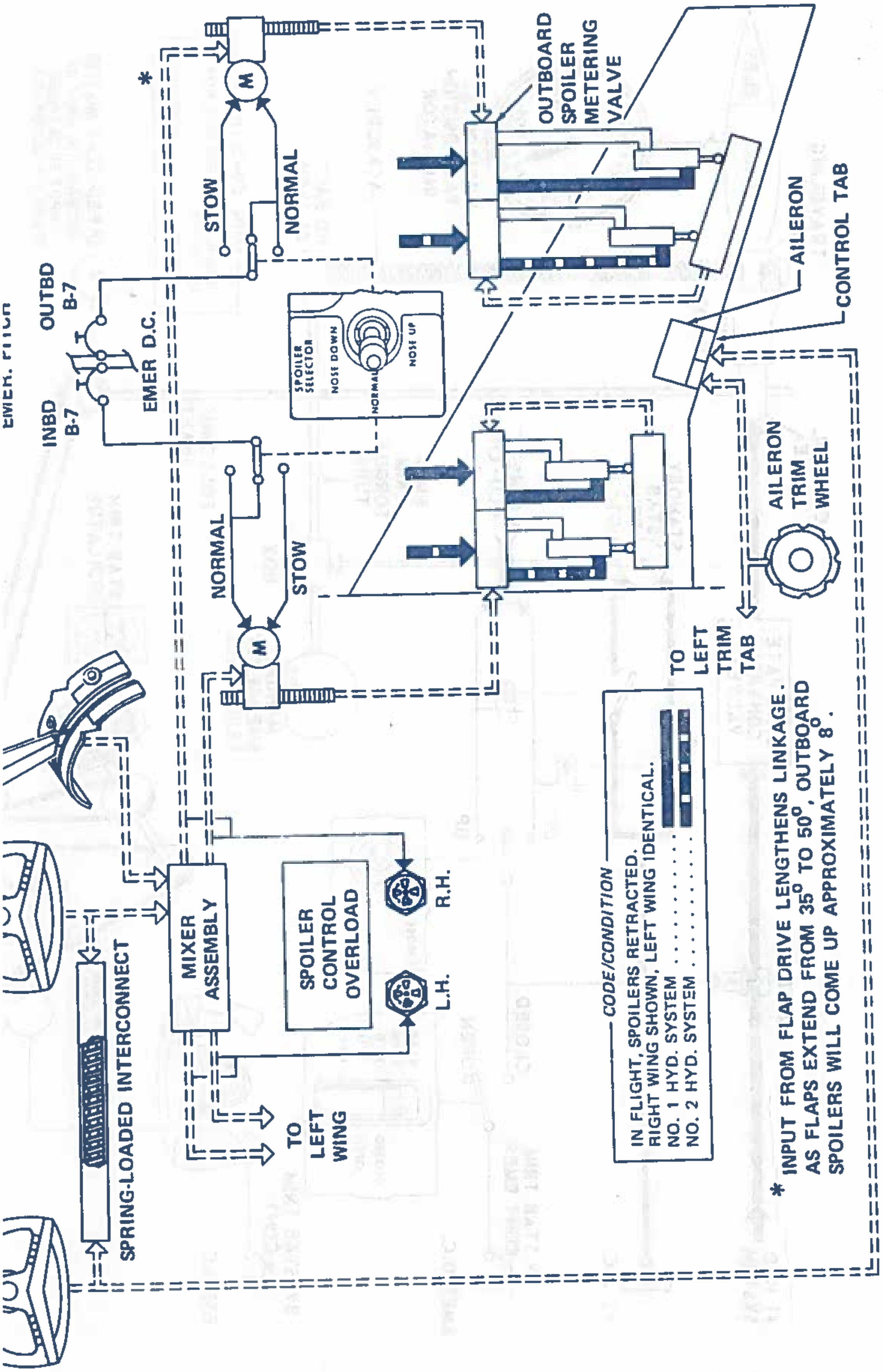
(4860)

C. STABILIZER TRIM SYSTEM

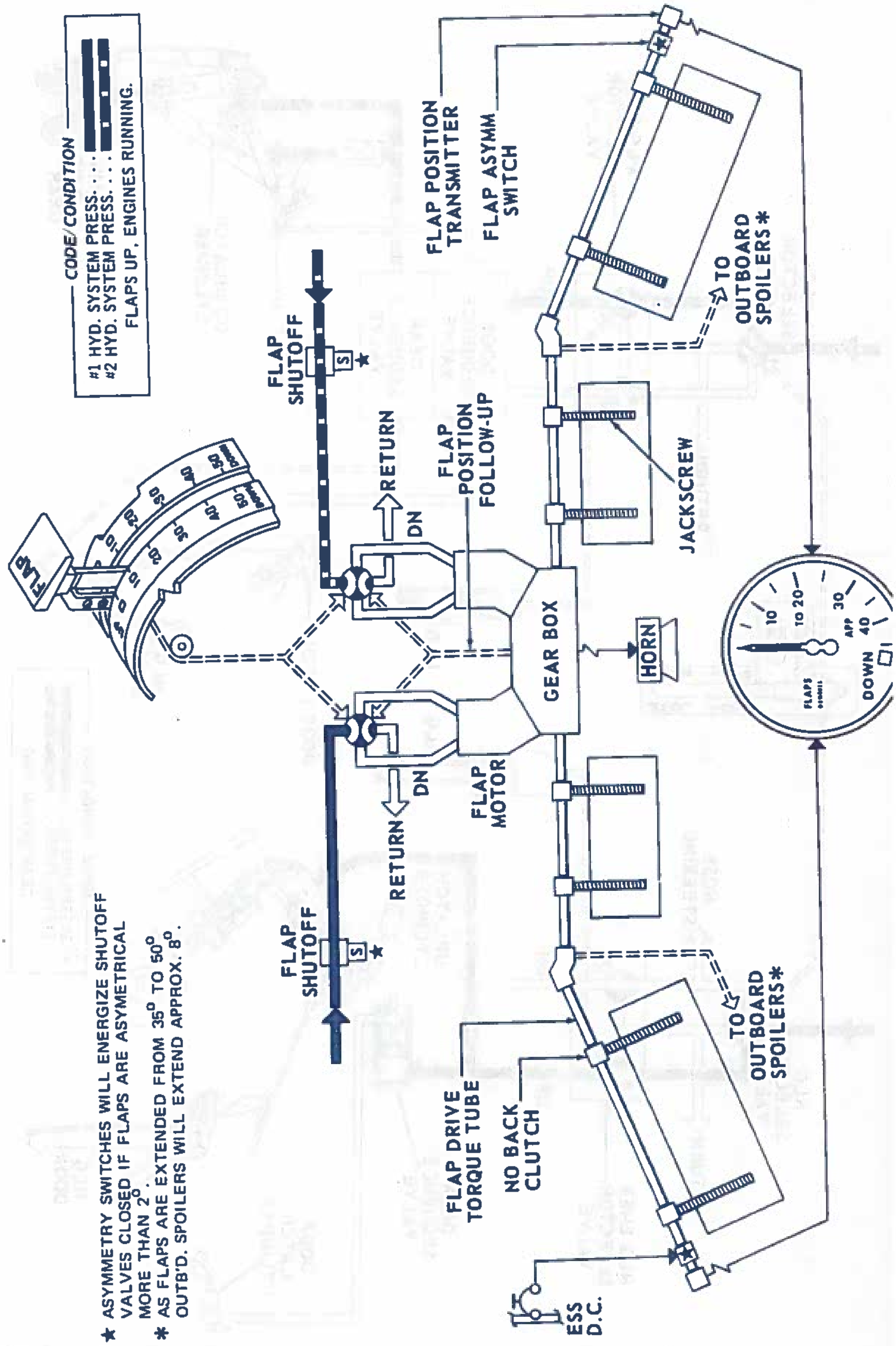


(4272)

AILERON SPOILER SYSTEM



E. FLAP OPERATION

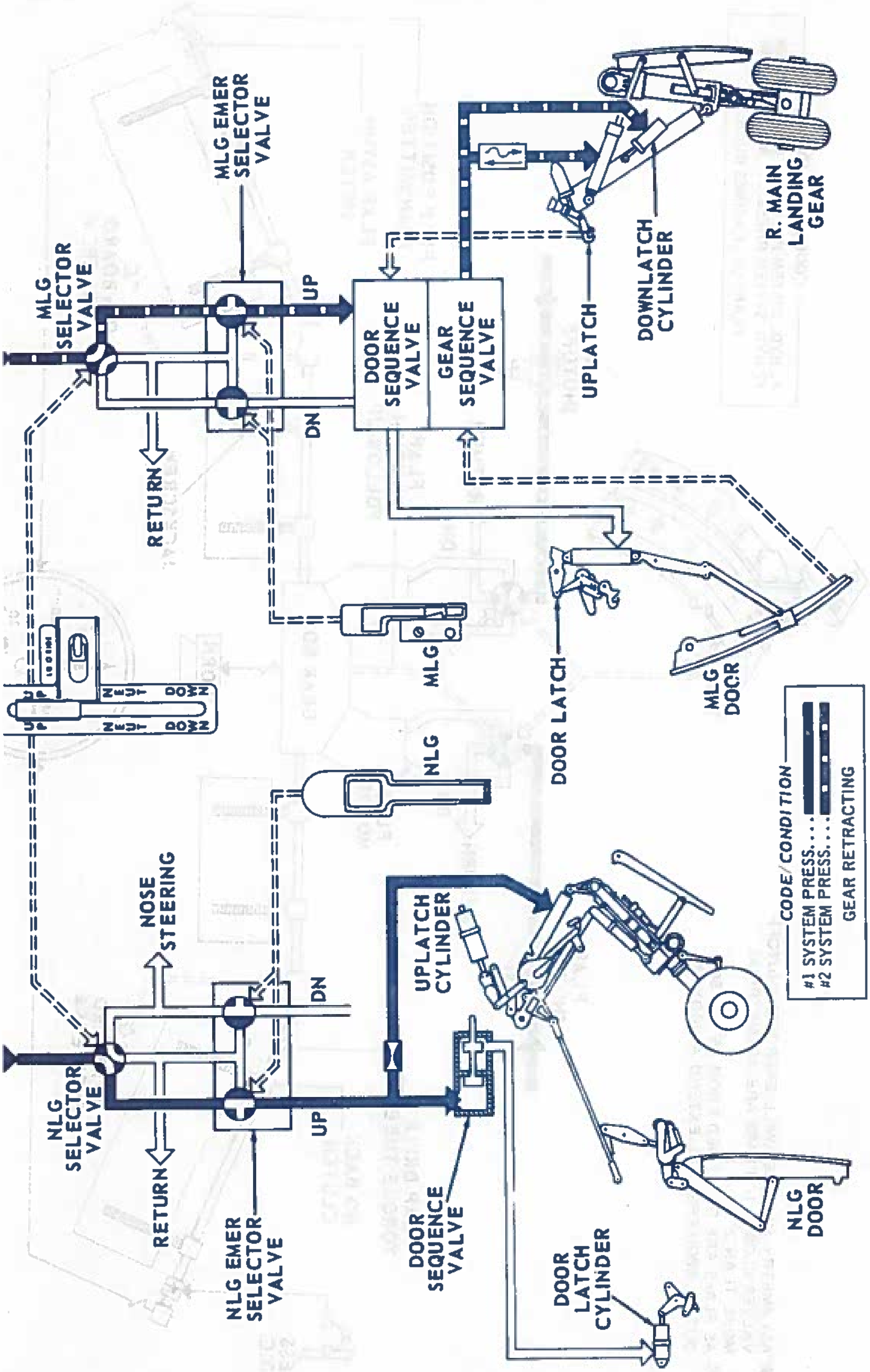


★ ASYMMETRY SWITCHES WILL ENERGIZE SHUTOFF VALVES CLOSED IF FLAPS ARE ASYMETRICAL MORE THAN 2°.

* AS FLAPS ARE EXTENDED FROM 35° TO 50° OUTB'D. SPOILERS WILL EXTEND APPROX. 8°.

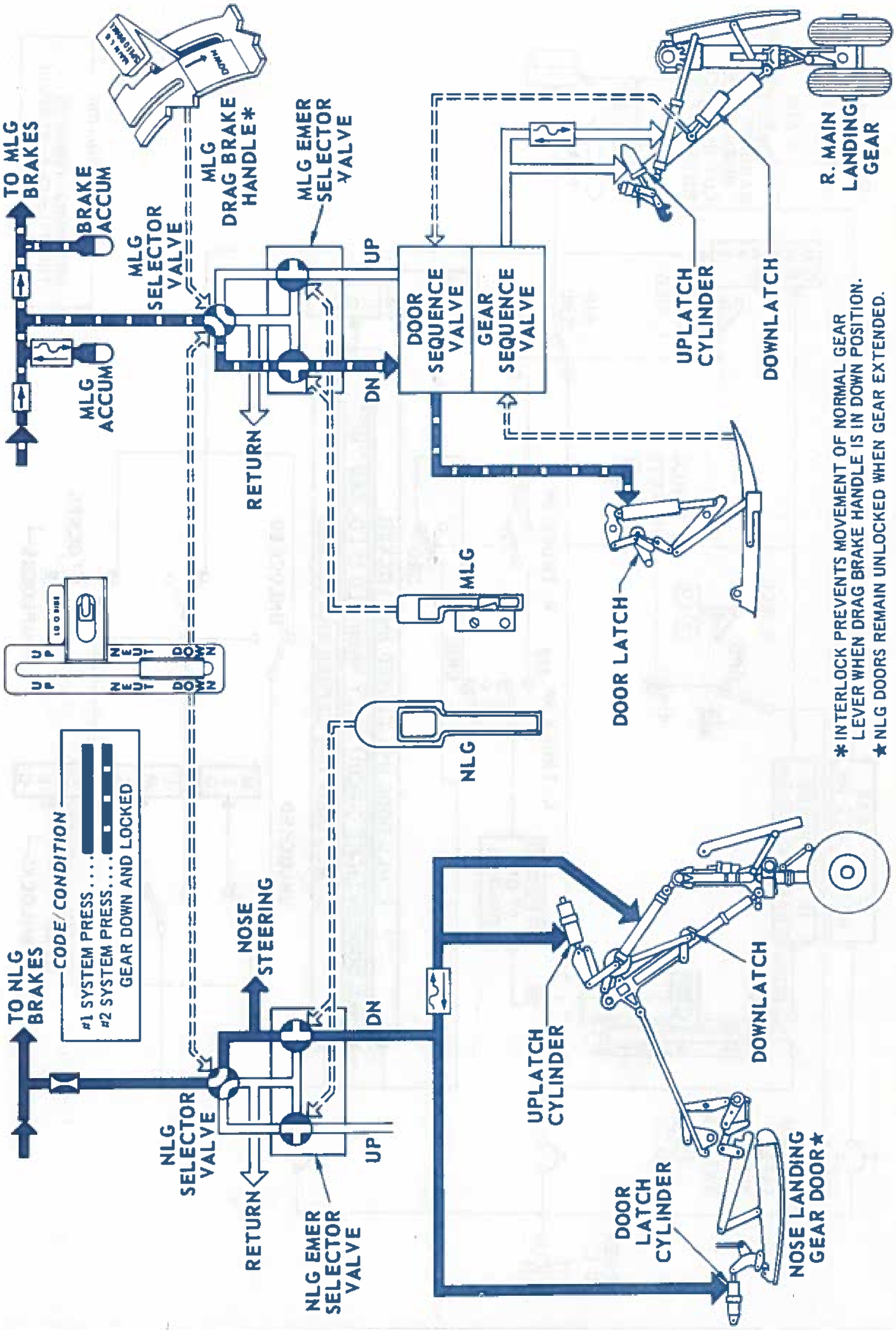
(4277)

LANDING GEAR HYDRAULIC OPERATION - RETRACTION



(4337)

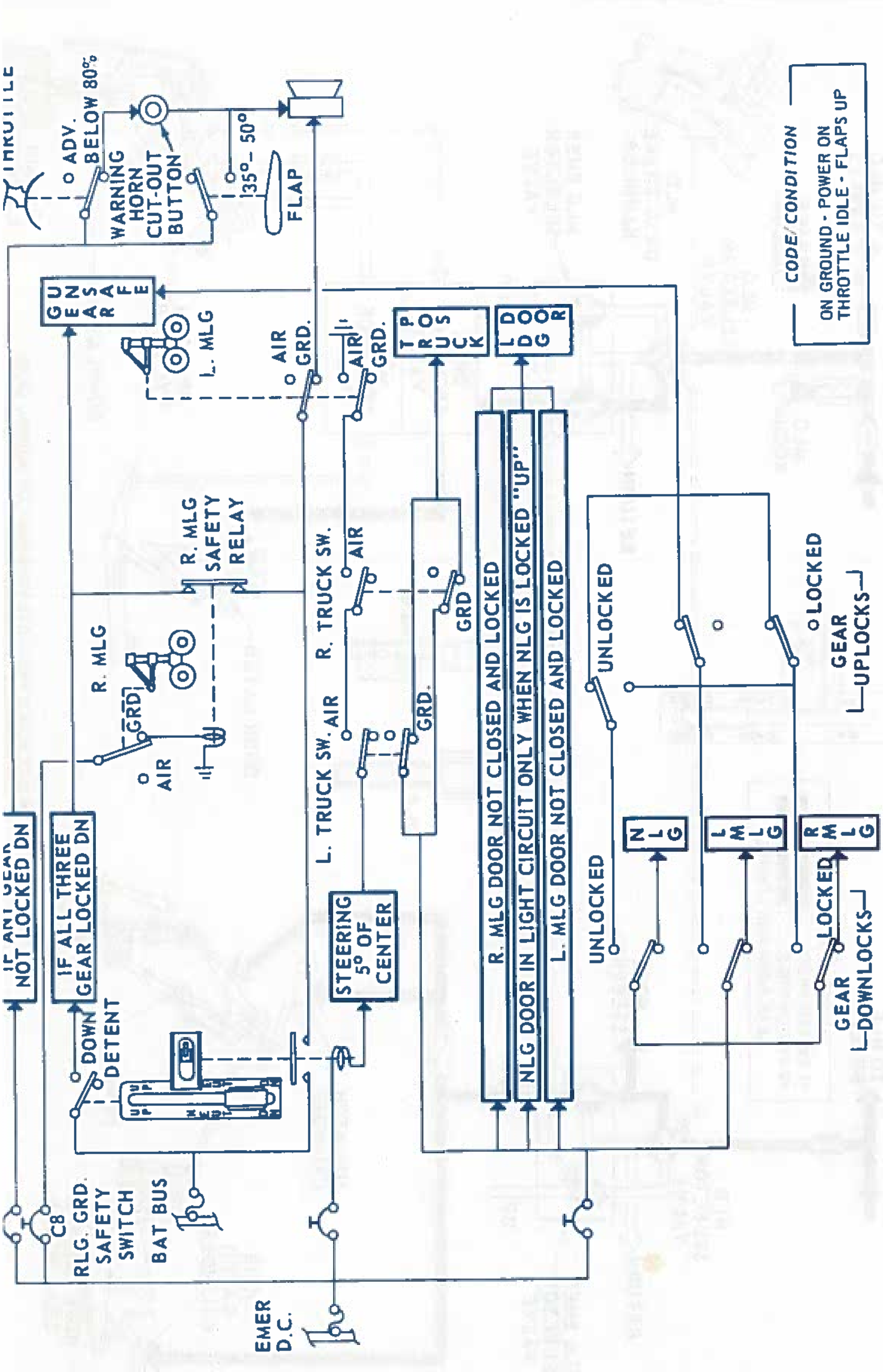
G. LANDING GEAR HYDRAULIC OPERATION - EXTENSION



(4336)

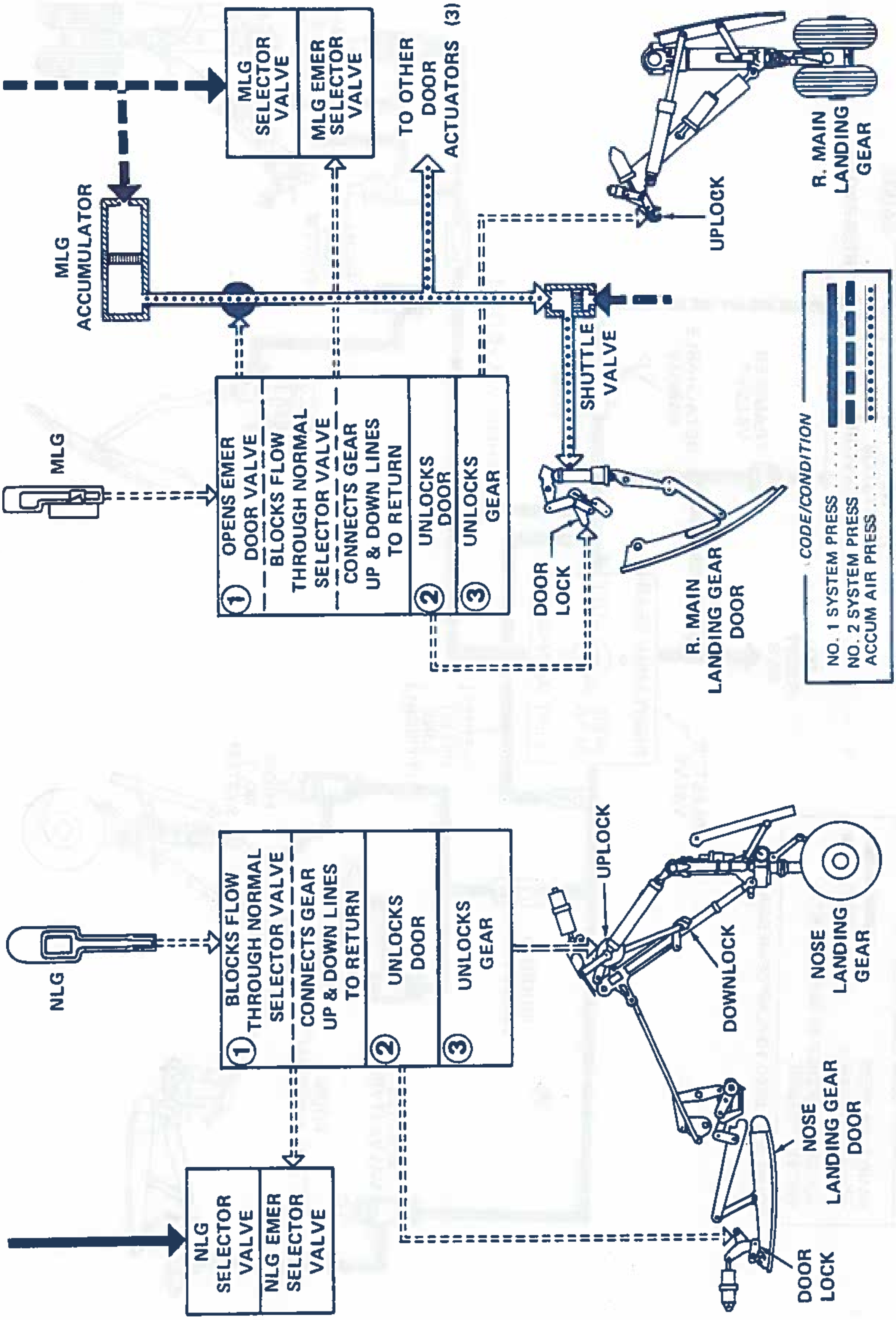
TRANS WORLD AIRLINES
CONVAIR 880
FLIGHT HANDBOOK

LANDING GEAR WARNING CIRCUIT



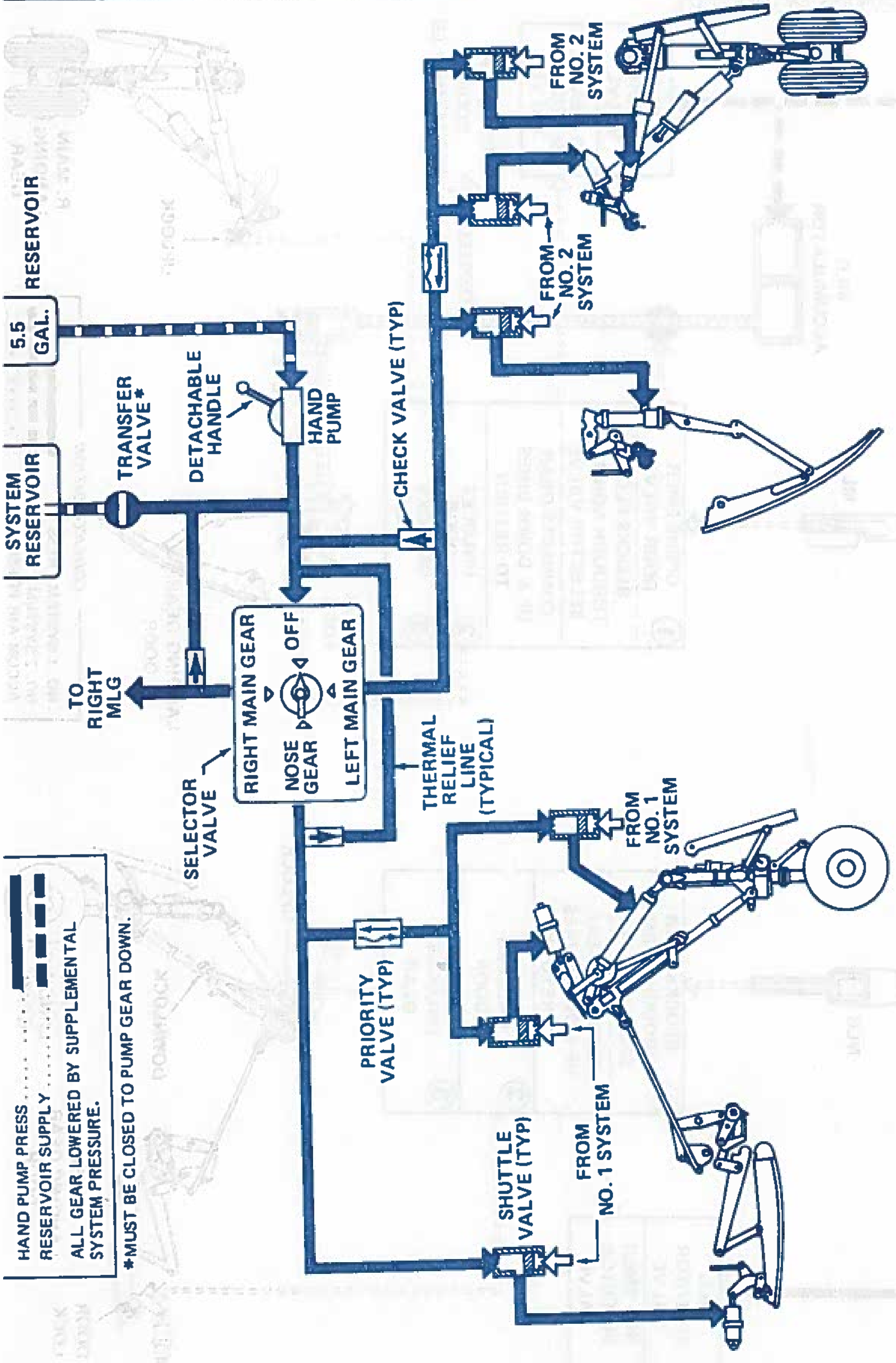
(4306)

I. MANUAL GEAR EXTENSION SYSTEM OPERATION



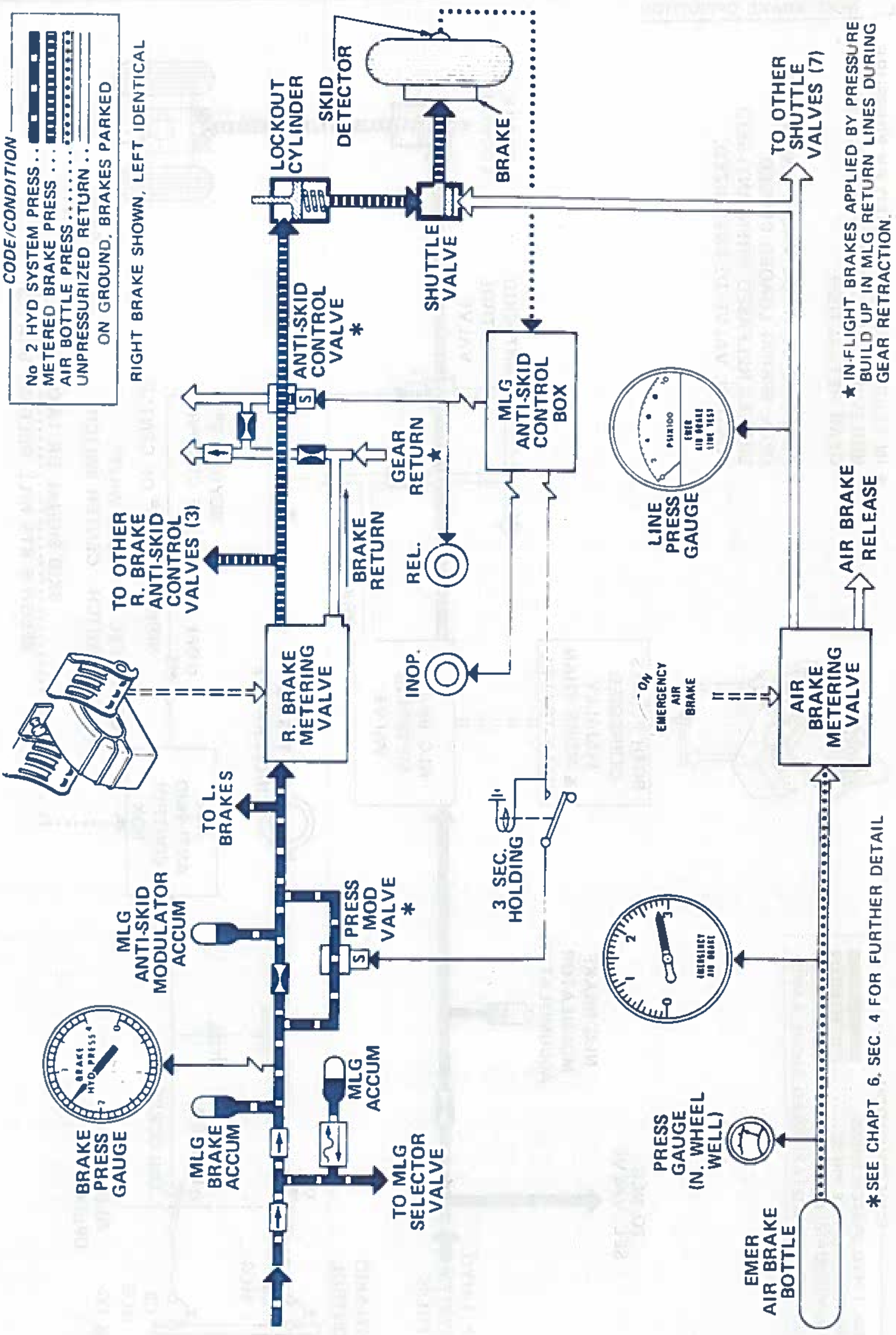
(4300)

IPPLEMENTAL GEAR EXTENSION SYSTEM OPERATION



(4257)

K. MAIN LANDING GEAR BRAKE OPERATION

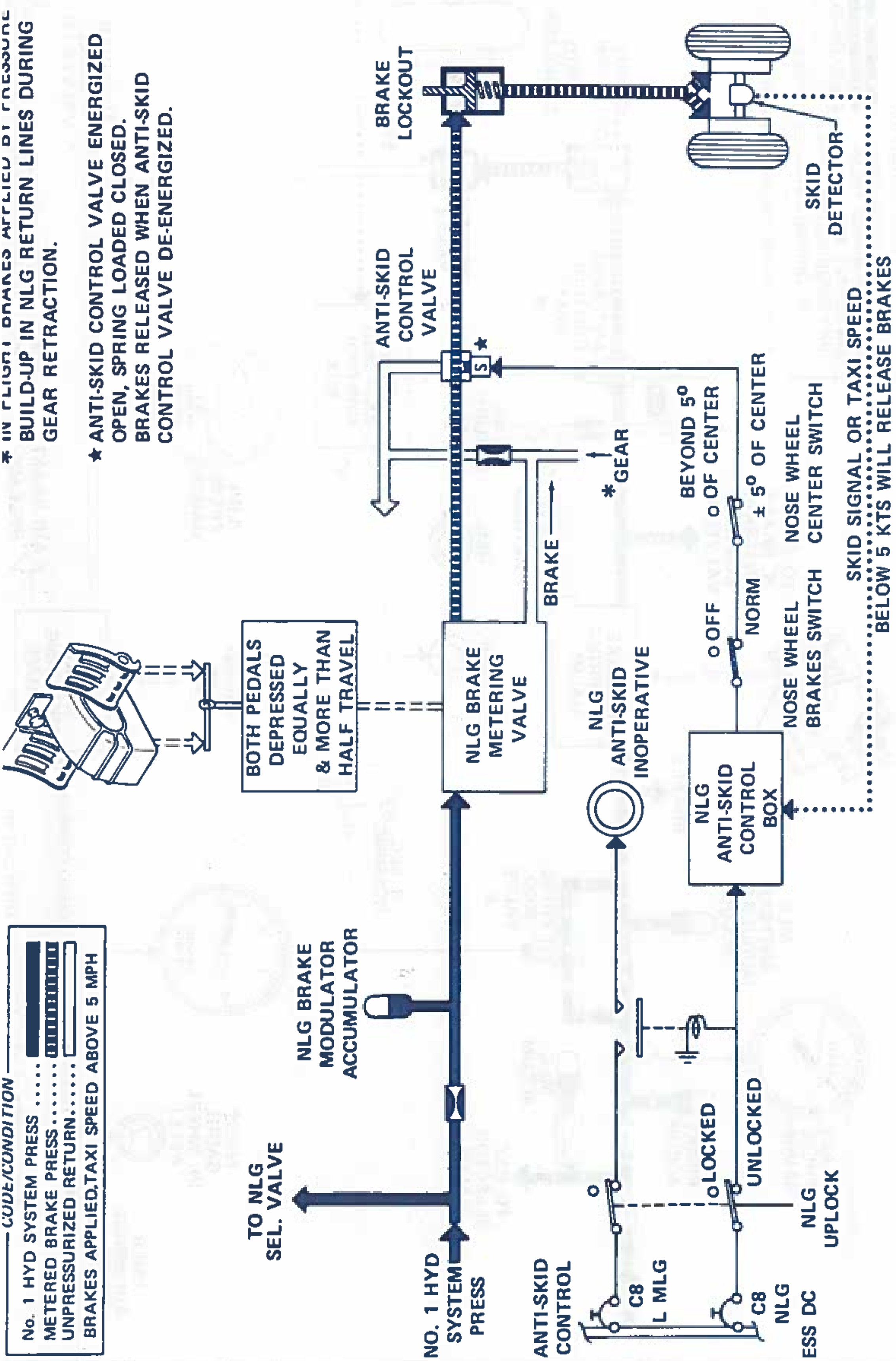


(4278)

NOSE BRAKE OPERATION

* IN FLIGHT BRAKES APPLIED BY PRESSURE BUILD-UP IN NLG RETURN LINES DURING GEAR RETRACTION.

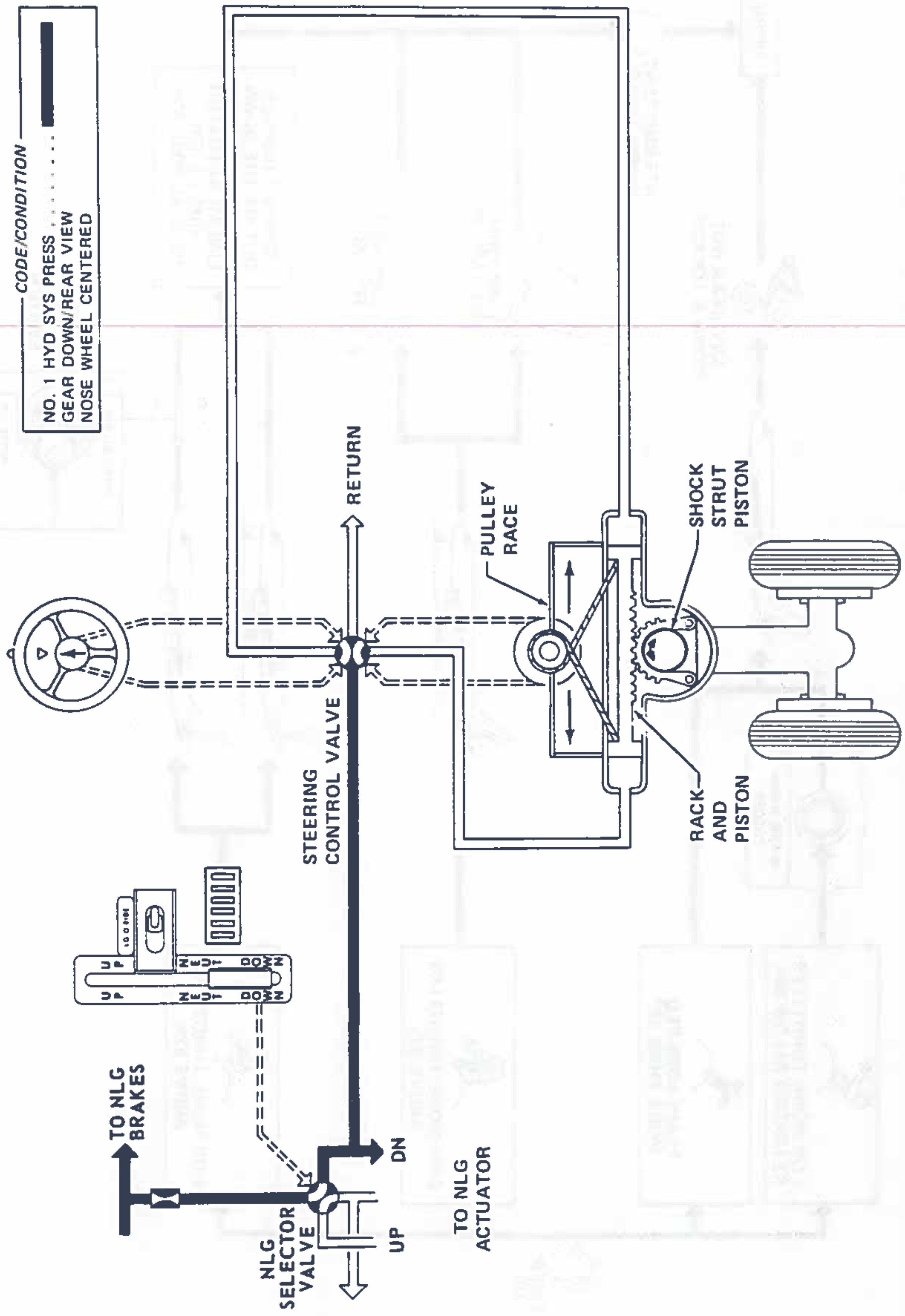
★ ANTI-SKID CONTROL VALVE ENERGIZED OPEN, SPRING LOADED CLOSED. BRAKES RELEASED WHEN ANTI-SKID CONTROL VALVE DE-ENERGIZED.



CODE/CONDITION
- No. 1 HYD SYSTEM PRESS ....
- METERED BRAKE PRESS........
- UNPRESSURIZED RETURN........
- BRAKES APPLIED,TAXI SPEED ABOVE 5 MPH

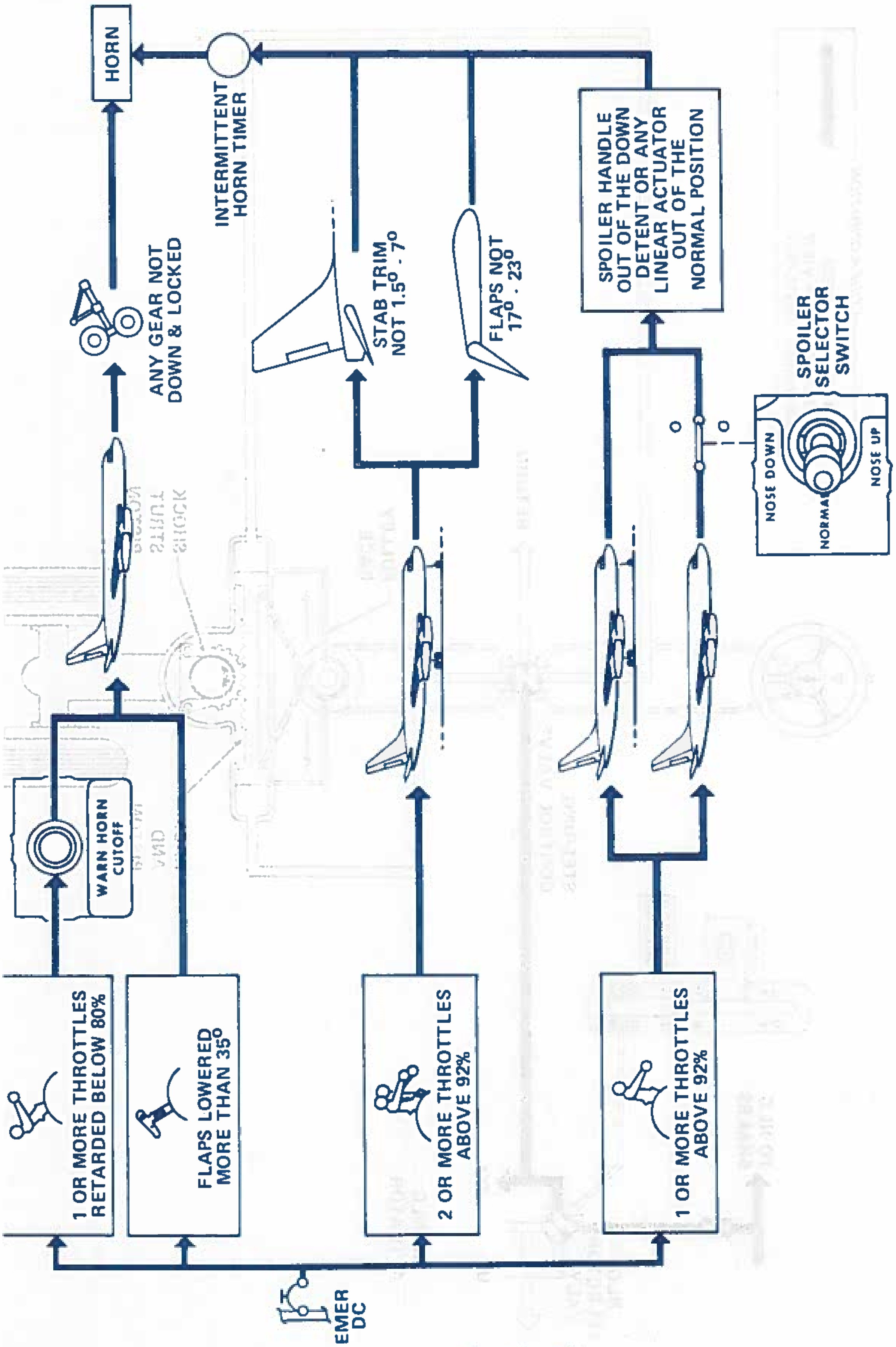
(4884)

M. STEERING



(4260)

WARNING HORN CIRCUIT



* * *

(4255)

A. HYDRAULIC POWER SYSTEM

1. There are two independent hydraulic systems in the Convair 880. The #1 system is supplied pressure by two engine driven pumps, one on each of the left engines. The #2 system is supplied pressure by two pumps driven by the right engines. Both systems use Skydrol fluid and both are 3000 PSI systems.

2. The two systems are identical except for reservoir capacities and units operated. The #1 reservoir is normally serviced to 1.5 and the #2 reservoir is serviced to 4.5 gallons. The #1 system operates the nose gear, nose wheel brakes, nose steering, stabilizer trim, and four fuel jettison pumps. The #2 system operates the main gear, main wheel brakes, and two fuel scavenge pumps. Pressure from both systems is normally used to operate the flaps and spoilers, but pressure from either system will operate them.

3. An electric auxiliary pump provides pressure to both systems for ground checking system units. The aux pump receives its fluid from the #2 reservoir. An arrangement of one way check valves prevent engine driven pumps in one system from pressurizing the other through the aux pump.

4. Most of the power system components are in the hydraulic compartment. Controls and indicators are on the Engineer's panel except for system pressure gauges and the brake pressure gauge, which are on the First Officer's instrument panel.

5. A motor driven valve in the interconnect line between the two reservoirs can be opened by turning on the aux pump. It is normally closed in flight to prevent contamination or loss of fluid in one system from affecting the other system.

6. A boost pump at each reservoir outlet supplies fluid under pressure to the engine driven pumps. System pressure drives the hydraulic motors which power the boost pumps.

7. Four supply shutoff valves, one in each engine pylon, are used to shut off fluid supply to the respective engine driven pump(s) if an engine failure, pump failure, or fluid loss occurs.

B. HYDRAULIC POWER SYSTEM CONTROL

1. The engine driven pumps are controlled by four switches on the Engineer's panel labeled "SHUTOFF VALVES." When a switch is in the ON position, engine pump output pressure is automatically controlled by a springloaded, pressure operated compensator valve within the pump. Should pressure drop below approximately 1250 PSI, a pressure actuated switch will cause the pump low pressure light to come on.

2. When the switch is in the OFF position, a solenoid operated depressurizing valve is energized open to depressurize the pump, and the pump low pressure light is deactivated.

3. Placing the switch to the INLET CLOSED position closes the supply shutoff valve and energizes the depressurizing valve open. The pump low pressure light will be on.

4. Pulling the firepull closes the supply shutoff valve and deactivates electrical power to the pump switch and the pump low pressure light.

5. A switch on the Engineer's panel labeled "HYD PUMP" controls the electric auxiliary pump and the reservoir interconnect valve.

C. FLIGHT CONTROLS

1. The primary flight control surfaces; ailerons, rudder, and elevators, are initially moved by control tabs connected to the cockpit flight controls. Once the control surface has begun to move, aerodynamic balance panels assist in control surface movement. Trim tabs are provided on the ailerons and rudder.

2. Pitch trim is accomplished by moving the horizontal stabilizer. Spoilers augment the ailerons in lateral control and can provide emergency pitch trim. The spoilers are also used as speed brakes during the landing roll and in some emergency descents.

3. The Captain's control wheel is connected directly to the aileron controls and the First Officer's wheel is connected to the spoiler controls. The two control systems are connected by a spring loaded interconnect tube, which permits normal control from either pilot position. Should either control wheel or either control system jam, limited control will be available through the other control wheel by overriding the spring in the interconnect tube.

4. Elevator control is exercised from either pilot position through dual sets of control cables. One set is connected to the Captain's control column and the other to the First Officer's. As in the Aileron/Spoiler system, the two sets of controls are connected by a spring loaded interconnect tube. This permits limited control if one system or control column should jam.

5. A Beta Box is installed in the vertical stabilizer and linked to the rudder control tab. It will tend to correct side slip induced by engine failure. The Beta Box is a required item for dispatch, therefore it must be checked for integrity of internal seals. A test switch and indicator light are installed on the Captain's console for checking the system. The green indicator light should illuminate when the test switch is positioned to On and either rudder pedal is given a rapid movement. The light should remain on until the switch is turned off.

6. Flutter dampers are installed in each primary flight control surface and their related control tabs to dampen aerodynamic flutter.

7. Gust snubbers connected to each primary control surface provide progressive snubbing as the surface is displaced by ground gusts. The flutter dampers and gust snubbers are self contained units and are not connected to either hydraulic system.

D. STABILIZER TRIM SYSTEM

1. Pitch trim is accomplished by varying the angle of incidence of the horizontal stabilizer. Two systems are provided for movement of the stabilizer, normal and standby. The normal system operates hydraulically and can be actuated three ways: By a thumb switch on each pilot's control wheel, a hand operated normal trim wheel on each side of the throttle quadrant, and an autopilot servo trim motor. The standby system operates electrically or manually and can be actuated two ways: By a toggle switch at the aft end of the pedestal, or by a large manual emergency trim wheel on each lower side of the pedestal.

STABILIZER TRIM SYSTEM

Actuation of the normal system operates a cable which rotates a followup shaft. Rotation of the followup shaft opens a control valve to port #1 system pressure to a hydraulic motor which drives a travel nut up or down on a locked jackscrew. The control valve, motor, and travel nut housing are attached to the stabilizer structure. Therefore, as the travel nut rotates on the jackscrew, the stabilizer is forced to move up or down, according to direction of nut rotation. As the stabilizer moves, the control valve will ride up or down on the helical followup shaft, automatically shutting off hydraulic pressure to the hydraulic motor when the amount of trim called for has been reached. The stabilizer will remain in position until trim is again actuated.

The followup shaft can also be rotated by the speed stability motor which receives automatic trim signals from the speed stability system. Refer to chapter 07.04 for further information on the speed stability system.

The rate of stabilizer trim will vary when using the normal trim system, depending on airspeed, position of the right main gear door, and whether or not the autopilot is engaged. A stabilizer rate switch in the hydraulic compartment controls the solenoid operated rate control valves which vary the volume of fluid flow to the hydraulic motor. Rates of stabilizer trim are as follows:

a. Airspeed below 250 knots - Normal (.4°/sec)

b. Airspeed above 250 knots - Half rate (.2°/sec)
(1) With right main gear door open - Normal (.4°/sec)

c. Autopilot engaged - Quarter rate (.1°/sec) regardless of speed or gear door position.

Actuation of the standby system, electrically or manually, rotates a torque tube which drives the jackscrew. With no hydraulic pressure, the hydraulic motor acts as a lock to prevent movement of the travel nut. The jackscrew rotates through the travel nut, forcing the stabilizer up or down according to direction of jackscrew rotation. The STAB TRIM HYD SHUTOFF switch must be in the "CLOSED" position to arm the toggle switch which controls the standby electric trim motor. The standby electric motor trims at approximately 1/4 the normal rate.

SPOILER/SPEED BRAKE SYSTEM

The four spoiler panels are left outboard, left inboard, right inboard, and right outboard. In normal operation, approximately 10° of aileron control wheel rotation will cause both spoilers on the "down" wing to start coming up. If the speed brake handle has been used to extend all spoilers as speed brakes, rotation of the aileron control wheel will cause the spoilers on both wings to move in the same direction as the related ailerons.

Either set of spoilers may be deactivated, allowing the other set to be extended for emergency pitch trim. If the spoiler selector switch is placed to the nose down position, both outboard spoilers will be deactivated and remain stowed. When the speed brake handle is then used to extend the inboard spoilers, nose down pitch proportional to the spoiler extension will occur.

When flaps are extended from 35° to 50° the outboard spoilers will come up to approximately 8° to provide more sensitive lateral control and to compensate for the nose down pitch caused by flap extension.

4. The spoiler control rods which extend from each side of the mixer assembly into the wing area are spring loaded. These "overload rods" will compress or extend if excessive drag or binding occurs in the spoiler control system between the mixer assembly and the spoiler metering valves. A switch on each rod will detect any compression or extension and illuminate the related spoiler control overload light in the cockpit.

F. **FLAP SYSTEM**

1. The four flap sections are left outboard, left inboard, right inboard, and right outboard. The flap sections are in the trailing edge of the wing, aft of the spoiler panels.

2. Flaps are normally operated by two hydraulic motors driving a single gear box, however, either motor will drive the gearbox. Flap operating time with either or both hydraulic systems operating is approximately 12 seconds for extension and 25 seconds for retraction.

3. Protection against split flap operation is provided by a flap asymmetry switch on each torque tube. The switches energize solenoid operated shutoff valves to the closed position when flaps become asymmetrical more than 2°. The asymmetry switches and shutoff valves operate independently of the flap position indicator. Operation of the shutoff valves is checked by placing the flap asymmetry test switch to the test position during flap operation

G. **LANDING GEAR SYSTEM**

1. The tricycle landing gear consists of (2) four wheel truck main gears and a steerable dual wheel nose gear. All landing gears retract into wheel wells which are fitted with wheel well doors. The main gears retract inboard into wheel wells located at the lower wing-fuselage juncture. The nose gear retracts forward into the fuselage. All landing gear doors are open only while the gear is in transit and are closed when the gear is down and locked or up and locked. The nose gear doors are mechanically connected to and operated by the nose gear. The main gear doors are operated hydraulically through sequence valves.

2. The main gear is hydraulically operated by the #2 system and the nose gear by the #1 system. They operate simultaneously by movement of a lever on the center instrument panel. A solenoid controlled lever lock, when de-energized, prevents inadvertently moving the landing gear control lever out of the down position before the aircraft is airborne. A second lever, on the control pedestal, may be used to lower the main landing gear only for use as drag brakes.

3. A truck positioner on each main gear truck positions the gear for retraction. Compressed air in the positioner cylinder acts on two equal area pistons to force the truck to the proper angle for retraction and extension. Proper alignment of the nose gear is accomplished by centering cams which cause the gear to center when the strut is extended.

4. Main landing gear strut extension varies with gross weight. At high gross weights very little, if any, of the chromed portion of the lower strut will be visible. When only a fraction of an inch of chrome is showing the strut still has two inches of travel. At low gross weights the strut has a proportionately greater amount of travel and a greater amount of the chromed portion will be visible.

H. MANUAL GEAR EXTENSION SYSTEM (LEVERS)

1. The two red levers are located on the aft end of the pedestal. The small short lever manually releases the main gear and the longer lever manually releases the nose gear.

2. The main gear manual extension lever is cable-connected to the emergency side of the MLG selector valve, the pneumatic emergency door open valve, four MLG door locks, and the two MLG uplocks.

3. The nose gear manual extension lever is cable connected to the emergency side of the NLG selector valve, the NLG door lock, and the NLG uplock.

I. SUPPLEMENTAL GEAR EXTENSION SYSTEM (HYDRAULIC)

1. The supplemental extension system is an independent, hand operated hydraulic system to be used when unable to extend the landing gear by the normal hydraulic means and the manual extension system. The system will unlock the landing gear doors, gear uplocks, and extend and lock each gear in the down position, individually.

2. Hydraulic pressure for the system is provided by a hand pump located in the hydraulic compartment. Fluid supply for the system is stored in a separate reservoir and an adequate supply of fluid is present when it can be seen through a "bulls eye" on the reservoir. Output of the hand pump is primarily routed through a selector valve directing fluid to one specific gear at a time. The pump and selector valve are located under a metal cover placarded L. G. EMERGENCY HAND PUMP. The removable handle for the pump is stowed inside the cover. Access to the hydraulic compartment is gained through a door in the cabin floor just forward of seat 17C.

3. A transfer valve located between the pump and No. 1 system reservoir is normally safetied in the OPEN position to relieve thermal expansion of fluid when the system is not in use. The valve also permits transfer of fluid from the supplemental system reservoir to the No. 1 system reservoir, if necessary. Fluid can be transferred by actuation of the hand pump when the gear selector valve is in the OFF position and the transfer valve is in the OPEN position.

CAUTION

DO NOT TRANSFER FLUID TO THE NORMAL HYDRAULIC SYSTEMS UNLESS ALL GEAR ARE DOWN AND LOCKED. Transfer of fluid prior to gear extension may result in an inadequete supply of fluid for gear extension using the supplemental system.

4. There are no pressure relief valves in the system, therefore operation of the hand pump can produce greater than normal pressure in the gear actuating cylinders to overcome excessive friction or binding in the actuating mechanism.

5. See Chapter 03. 12 for supplemental gear extension system procedures.

J. BRAKE SYSTEM

1. The brake system includes hydraulic multiple disc brakes for each wheel, a parking brake, an anti-skid system, and an emergency air brake system. In normal operation, brakes are applied by depressing either the captain's or the first officer's pedals. The parking brake can be set by depressing either set of pedals and pulling out the parking brake handle. It is released by depressing either set of pedals.

2. Inflight braking is provided by a restrictor in the gear up return line causing return line pressure to build up and be diverted to the brake system.

3. The main anti-skid system provides protection against wheels locking when normal brakes are applied. This is accomplished by a skid detector in each wheel sensing the decrease in wheel RPM and signaling the anti-skid control box. The anti-skid control box in turn signals the proper anti-skid control valve(s) to release pressure to the affected wheel(s). Simultaneously, action of the pressure modulator valve and modulator accumulator reduces pressure to all other main wheel brakes. At taxi speeds below approximately 10 mph, the anti-skid system drops out and only manual braking is available to the main gear wheels.

4. The nose brake anti-skid system provides the same protection to the nose brakes, except that when electrical power is not available to the nose anti-skid control valve or at taxi speeds below 5 mph, nose wheel brakes are inoperative.

5. The air brake system applies air pressure directly to all main wheel brakes when actuated; therefore the anti-skid system, parking brake, and differential braking do not function when the emergency air brakes are used.

K. NOSE GEAR STEERING

1. Nose gear steering is accomplished by using the steering wheel at the forward end of the captain's side panel. The angle of the nose wheels is indicated by a rivet on the outer circumference of the steering wheel. The rivet will be at the top center of the wheel when the nose gear is centered.

2. Steering is possible through 70° each side of center, however steering in excess of 56° is not recommended because of tire scuffing and possible damage to the strut due to excessive torque loads.

3. Hydraulic pressure for steering is available anytime the #1 system is pressurized and the landing gear lever is in the down position. If pressure is not available, the nose gear will caster freely 70° each side of center, allowing directional control by use of differential thrust and braking.

* * *

* * *

INSTRUMENT DIFFERENCES AND TOLERANCES

To determine instrument differences and tolerances, use stabilized instrument readings after Cruise Flight has been established. Instrument readings that are not within the allowable tolerances or differences, require a logbook write-up.

INDICATED AIRSPEED

KTS	Difference between Indicator Readings
120 - 220	4
260 - 380	6

MAXIMUM AIRSPEED POINTERS

The maximum difference between pointers is 10 knots.

MACHMETER

The maximum difference between indicators is .015 mach.

ALTITUDE ALERT UNIT

The tolerance for light and beep tone signals is ± 130 feet.

STATIC AIR TEMPERATURE

Corrected SAT may be derived from indicated SAT by applying the following correction.

	Indicated Mach. .3	.5	.7	.9
Corrected SAT = Indicated SAT	-4°	-5°	-6°	-7°

Example: If SAT indicator reads -50 while at mach. 82, corrected SAT is -57.

To determine if the SAT gauge is within tolerances enter the OAT-RAT Conversion Table with indicated RAT and MACH and read OAT. Compare this reading with Corrected SAT. A difference of ± 4° requires a logbook write-up.

TRUE AIRSPEED

Corrected TAS may be derived from indicated TAS by applying the following correction.

	Indicated Mach. .3	.5	.7	.9
Corrected TAS = Indicated TAS	-4 kts	-5 kts	-6 kts	-7kts

To determine if TAS is within tolerances, determine Chart TAS from the Constant Mach Cruise Chart. Compare this reading with the corrected TAS. A difference of ± 10 knots requires a logbook write-up.

NORMAL STATIC INSTRUMENT ERRORS

KIFIS OFF ALTIMETER STATIC ERRORS (NORMAL STATIC)

Pressure Altitude (Flaps Up)	INDICATED ALTITUDE VS IAS					
	160 KTS	200 KTS	APPLIES TO ALL WEIGHTS			
	150,000#	150,000#	280 KTS	300 KTS	320 KTS	340 KTS
10,000'	10,080'	10,018'	9,944'	9,940'	9,932'	9,924'
20,000'	20,104'	20,024'	19,924'	19,918'	19,916'	19,894'
25,000'	25,125'	25,030'	24,905'	24,900'	24,888'	24,872'
30,000'	30,150'	30,033'	29,894'	29,884'	29,866'	29,850'
35,000'	35,180'	35,042'	34,872'	34,858'	-	-
40,000'	-	40,050'	39,840'	-	-	-

NOTE
This Chart does not include correction for instrument errors present with KIFIS power off as this error varies for each altimeter.

ALTERNATE STATIC INSTRUMENT ERRORS

The errors induced in the airspeed, mach and altimeter by use of alternate static can be sizeable, depending on speed range and altitude. The errors always cause the indications to be higher than actual (altitude or speed). The following paragraphs give some examples.

AIRSPEED ERROR

CORRECTED IAS (CAS)	IAS
160	162
180	184
220	227
260	271
300	315
340	357

MACHMETER ERROR

CORRECTED MACH (TRUE MACH)	IND. MACH
.71	.75
.75	.795
.77	.82
.805	.86
.82	.88
.86	.92

ALTIMETER ERROR

PRESSURE ALTITUDE	INDICATED ALTITUDE @ 180 KTS	INDICATED ALTITUDE @ 260 KTS	INDICATED ALTITUDE @ 320 KTS
1,000 FT.	1,055 FT.	1,240 FT.	1,450 FT.
10,000 FT.	10,080 FT.	10,370 FT.	10,580 FT.
20,000 FT.	20,120 FT.	20,440 FT	20,810 FT.
30,000 FT.	30,170 FT.	30,630 FT.	31,150 FT.
40,000 FT.	40,250 FT.	40,950 FT.	

In addition to the errors present in the airspeed, mach and altimeters, whenever the captain's static system is on alternate source, the true airspeed and static air temperature indicators will have a significant error since the captain's Machmeter is feeding information to the instrument computers.

NORMAL PITOT STATIC INSTRUMENT READINGS

:onsistent readings between the captain's and first officer's struments can indicate either a leak, blockage or icing in the stem. The indications may vary, depending on speed, altile, and nature of the malfunction. An icing problem or ockage might cause the affected instrument to read zero or ly a small error might exist. Performance charts should sist in determining which system is in error if small errors e noted. During flight, occasional cross checks between the ptain and first officer's instruments should be made. If altieters differ, they can be checked for accuracy during an ILS proach, using the approach plate glide slope intercept altile. If any altimeter differences exist, the lowest reading imeter should be used.

NORMAL ALTIMETER READINGS

there is a significant altimeter difference:

ieck ALTM THUMPER circuit breaker in (A-3), and verify rmal altimeter vibrator operation.

ieck ALT SEL valves NORMAL and AUX EQUIP SEL valve .

ieck AIR DATA FLT INST circuit breakers (C-11) in and KIFIS fail flags visible.

NORMAL READINGS CAPTAIN'S PITOT STATIC INSTRUMENTS

ptain's altimeter, IAS, rate of climb and machmeter in ror. If these instruments are in error:

ieck pitot switch and light on.

ieck captain's ALT SEL valve NORMAL.

condition still exists and an alternate air source is desired:

ill the PILOT AIR DATA FLT INST circuit breaker (C-11).

ace the captain's ALT SEL valve to ALT.

ow to speed stability inoperative limits; mach .73 or 335 IAS r conditions other than emergency descent.

sregard SAT and TAS. Their information will be inaccurate.

ABNORMAL READINGS - FIRST OFFICER'S PITOT STATIC INSTRUMENTS

If the first officer's altimeter, IAS, machmeter and rate of climb are in error:

Check to ensure both pilot switches are on and the respective blue lights are illuminated.

Check to ensure the ALT SEL valve is in the NORMAL detent and the AUX EQUIP SEL valve is in the ON position.

Slow to speed stability inoperative limits. (mach .73 or 335)

Place first officer's ALT SEL valve to the ALT position. Static air is now being supplied from the vertical stabilizer section, and the static error correction cam in the first officer's KIFIS computer is deactivated. The correction charts in this section should be noted and also the first officer's instrument should be cross checked against the captain's instruments.

If no improvement is noted concerning the first officer's instruments, return the ALT SEL valve to the NORMAL position, and place the AUX EQUIP SEL valve to OFF. If there is a leak in the lines and units affected by this valve, the altimeter IAS, machmeter and rate of climb indicators should return to normal. Speed stability inoperative limits must still be observed, however, because with the valve in the OFF position, there will be no inputs to speed stability from the first officer's system.

If no improvement is noted, return AUX EQUIP valve to ON and resume normal speed using the captain's instruments for accurate indications. Caution must be exercised when making instrument approaches. Use the ILS with operating glide slope when possible to verify altimeter accuracy.

AUX EQUIPMENT SELECTOR VALVE

If the AUX EQUIP SEL valve is placed in the OFF position because of suspected leaks downstream in the first officer's system, the following will apply:

AUTOPILOT - will be affected because there will be no ram air to the autopilot system. It will be sluggish when making turns and oversensitive in pitch control. Static air from the autopilot static ports is still available, trying to maintain altitude if ALT HOLD is ON. The autopilot should be turned OFF because of erratic operation.

FLIGHT DIRECTORS - will not be affected because they need only static air which they are receiving from a separate source.

SPEED STABILITY - will be affected, because the only inputs will be received from captain's KIFIS when above mach .80. First officer's inputs will be deactivated. Therefore, speed stability limits must be observed any time this valve is in the OFF position.

FLIGHT RECORDER - will be affected because no airspeed or altitude information will be available.

MACH AIRSPEED WARNING - will be deactivated because there are no ram or static inputs to the switchbox assembly. Indicators on IAS and machmeters should be closely monitored so that V_{mo} or M_{mo} limits are not exceeded.

STABILIZER RATE SWITCH - will be affected depending on whether some air is trapped in the system or depleted. If depleted, rate of stabilizer movement will not be consistent with normal movement rates. If air is trapped in the system, rate of stabilizer movement will be at last rate prior to placing switch OFF.

CABIN DIFFERENTIAL INDICATOR - will be affected because only cabin air is being used. The instrument will not be reliable.

KIFIS

If a power failure occurs to either KIFIS Computer, the altimeter will not be corrected for either scale or static errors. At the lower altitudes, this is not significant, and the pilot should realize the altimeter is usable but not corrected. A loss of power at a higher altitude might result in the altimeter being off from 200-500 feet depending on scale cam adjustments.

POWER LOSS OCCURING TO THE CAPTAIN'S KIFIS:
If this occurs, a white chevron or white triangle will be noted on the face of the captain's altimeter.

Check to ensure the PILOT AIR DATA FLT INST circuit breaker (C-11) has not tripped.

If condition cannot be corrected, speed stability inoperative limits (mach .73 or 335) must be observed.

TAS and SAT indicators will not be accurate.

The first officer's altimeter should be used for accurate indications. Caution should be exercised if in instrument conditions.

POWER LOSS OCCURING TO THE FIRST OFFICER'S KIFIS
If this occurs, a white chevron or white triangle will be noted on the face of the first officer's altimeter.

Check to ensure the CO-PILOT AIR DATA FLT INST circuit breaker (C-11) has not tripped.

The captain's altimeter should be used for accurate indications. Caution should be exercised if in instrument conditions.

ABNORMAL KIFIS TEST
The altimeter check should be disregarded at airports in the vicinity of 5000 feet. The altimeters will not increase approximately 350 feet at these airports. If at other airports, and the altimeters only increase approximately 200 feet, the position of the ALT SEL valves should be noted.

SPEED STABILITY

Faulty signals to the speed stability system can result in the horizontal stabilizer moving in an erratic manner. Therefore if the speed stability system is affected during flight, the inoperative limits must be observed. (mach .73 or 335)

If the SPEED STAB fail light illuminates during flight and remains on, speed stability inoperative limits must be observed.

If either ALT SEL valve or AUX EQUIP SEL valve is moved from its normal position, during flight, the speed stability inoperative limits must be observed.

If the #1 hydraulic system is inoperative, speed stability limits must be observed.

If a power failure occurs to the captain's KIFIS, speed stability limits must be observed.

MACH AIRSPEED WARNING

If either V_{mo} or M_{mo} is reached during flight, an intermittent bell will ring.

If an intermittent bell rings during flight, slow the aircraft until below the V_{mo} or M_{mo} limit. Circuit breaker protection is provided on "A" panel. V_{mo} - M_{mo} Warn.

STANDBY MAGNETIC COMPASS

If it becomes necessary to conduct navigation using the standby magnetic compass, the flight crew should be alert for compass errors due to "other than Normal electrical loads in use." This could be in addition to those common to the compass itself, such as turns, speed changes, etc.

LOSS OF WATER SUPPLY

If the water system becomes inoperative or if the water supply is shut off to a lavatory or galley, the appropriate water heater should be turned off.

In addition, the lavatory water heater shall be deactivated by means of the circuit breaker (if installed) located on the electrical junction box adjacent to the water heater.

ALTERNATE WATER SYSTEM PRESSURIZATION

An air valve installed in the water service panel provides an alternate method of pressurizing the water system if the air compressor is inoperative and cannot be replaced with a serviceable unit prior to dispatching the aircraft. The water storage tank should be filled to approximately one-half full (25 gallons), then the tank charged with nitrogen or clean compressed air to 25 PSI.

LLEY WATER LEAKS

heck should first be made of the waste containers located ind the upper food storage cabinets in each galley. If er is not found to be leaking from a container, then it must assumed a water supply line is at fault and the appropriate ley shutoff valve should be closed.

ater has been leaking in the forward galley area, the etrical compartment should be checked to determine if components have been affected.

VATORY HEATER OVERHEAT

aircraft having the electrical junction box circuit breaker, uld a lavatory heater "lock out" due to overheating (circuit aker open) perform the following:

ke certain the lavatory water supply line shutoff valve se of fwd. LAVATORY cabinet and below water heater LEFT AFT Lavatory) is open and the heater is free of pockets by opening the hot water faucet, allowing water flow through heater for several minutes.

ose hot water faucet and close circuit breaker. If circuit eaker opens again (approximately 15 minutes) it indicates t the heater cycling switch is defective and that the heater uld be left deactivated. If the circuit breaker does not open er resetting, the previous trip was probably caused by a nsient condition.

en either heater is deactivated (circuit breaker open), the propriate water heater switch shall be turned off.

NOTE

Do not pull circuit breakers in cockpit (Panel A2) as this will deactivate both heaters.

ERATIONAL CHECK OF ALTITUDE ALERT

curacy of light and beep tone signals can be checked by ing the following procedure:

t unit altimeter setting to agree with the captain's barometric imeter setting.

gin check with unit approximately 2000 feet higher than ptain's altimeter. If red light is flashing, extinguish by pressing ALT crank.

ecrease altitude on unit, approaching captain's altimeter dication. Amber light will come on when 1000 feet from s altimeter. Momentary beep will sound when 500 feet from s altimeter. Green light will come on and amber light will tinguish when within 250 feet from altimeter indication.

ontinue to decrease altitude below the altimeter indication. 250 feet below altimeter indication, the green light will tinguish and momentary beep will sound. 500 feet below altimeter indication, the red light will flash. Push ALT crank extinguish.

fter completing this check, reset unit's altitude and altimeter tting as required.

* * *

D. **PITOT STATIC PROCEDURES**

f. Stabilizer Rate Switch - will be affected depending on whether some air is trapped in the system or depleted. If depleted, rate of stabilizer movement will not be consistent with normal movement rates. If air is trapped in the system, rate of stabilizer movement will be at last rate prior to placing switch OFF.

g. Cabin Differential Indicator - will be affected because only cabin air is being used. The instrument will not be reliable.

E. **KIFIS PROCEDURES**

If a power failure occurs to either KIFIS computer, the altimeter will not be corrected for either scale or static errors. At the lower altitudes, this is not significant, and the pilot should realize the altimeter is usable but not corrected. A loss of power at a higher altitude might result in the altimeter being off from 200-500 feet depending on scale cam adjustments.

1. Power Loss Occuring to the Captain's KIFIS:
If this occurs, a white chevron or white triangle will be noted on the face of the Captain's altimeter.

a. Check to insure the PILOT AIR DATA FLT. INST circuit breaker (C-11) has not tripped.

b. If condition cannot be corrected, speed stability inoperative limits (mach .73 or 335) must be observed.

c. TAS and SAT indicators will not be accurate.

d. The First Officer's altimeter should be used for accurate indications. Caution should be exercised if in instrument conditions.

2. Power Loss Occuring to the First Officer's KIFIS:
If this occurs, a white chevron or white triangle will be noted on the face of the First Officer's altimeter.

a. Check to insure the CO-PILOT AIR DATA FLT INST circuit breaker (C-11) has not tripped.

b. The Captain's altimeter should be used for accurate indications. Caution should be exercised if in instrument conditions.

3. Abnormal KIFIS Test:
The altimeter check should be disregarded at airports in the vicinity of 5000 feet. The altimeters will not increase approximately 350 feet at these airports. If at other airports, and the altimeters only increase approximately 200 feet, the position of the ALT SEL valves should be noted.

F. **SPEED STABILITY PROCEDURES**

Faulty signals to the speed stability system can result in the horizontal stabilizer moving in an erratic manner. Therefore, if the speed stability system is affected during flight, the inoperative limits must be observed. (mach .73 or 335)

a. If the SPEED STAB fail light illuminates during flight and remains on, speed stability inoperative limits must be observed.

b. If either ALT SEL valve or AUX EQUIP SEL valve is moved from its normal position, during flight, the speed stability inoperative limits must be observed.

c. If the #1 hydraulic system is inoperative, speed stability limits must be observed.

d. If a power failure occurs to the Captain's KIFIS, speed stability limits must be observed.

G. **MACH AIRSPEED WARNING**

If either V_{mo} or M_{mo} is reached during flight, an intermittent bell will ring.

a. If an intermittent bell rings during flight, slow the aircraft until below the V_{mo} or M_{mo} limit. (Circuit breaker protection is provided on "A" panel.) V_{mo}-M_{mo} Warn

H. **STANDBY MAGNETIC COMPASS**

If it becomes necessary to conduct navigation using the standby magnetic compass, the flight crew should be alert for compass errors due to "other than normal electrical loads in use." This could be in addition to those common to the compass itself, such as turns, speed changes, etc.

I. **LOSS OF WATER SUPPLY**

If the water system becomes inoperative or if the water supply is shut off to a lavatory or galley, the appropriate water heater should be turned off.

In addition, the lavatory water heater shall be deactivated by means of the circuit breaker (if installed) located on the electrical junction box adjacent to the water heater.

J. **ALTERNATE WATER SYSTEM PRESSURIZATION**

An air valve installed in the water service panel provides an alternate method of pressurizing the water system if the air compressor is inoperative and cannot be replaced with a serviceable unit prior to dispatching the aircraft. The water storage tank should be filled to approximately one-half full (25 gallons), then the tank charged with nitrogen or clean compressed air to 25 PSI.

K. **GALLEY WATER LEAKS**

A check should first be made of the waste containers located behind the upper food storage cabinets in each galley. If water is not found to be leaking from a container, then it must be assumed a water supply line is at fault and the appropriate galley shut off valve should be closed.

If water has been leaking in the forward galley area, the electrical compartment should be checked to determine if any components have been affected.

L. **LAVATORY HEATER - OVERHEAT**

On aircraft having the electrical junction box circuit breaker, should a lavatory heater "lock out" due to overheating (circuit breaker open) perform the following:

1. Make certain the lavatory water supply line shutoff valve (base of fwd. LAVATORY cabinet and below water heater in LEFT AFT Lavatory) is open and the heater is free of air pockets by opening the hot water faucet, allowing water to flow through heater for several minutes.

LAVATORY HEATER - OVERHEAT

2. Close hot water faucet and close circuit breaker. If circuit breaker opens again (approximately 15 minutes) it indicates that the heater cycling switch is defective and that the heater should be left deactivated. If the circuit breaker does not open after resetting, the previous trip was probably caused by a transient condition.

3. When either heater is deactivated (circuit breaker open), the appropriate water heater switch shall be turned off.

NOTE

Do not pull circuit breakers in cockpit (Panel A2) as this will deactivate both heaters.

* * *

A. CONTROLS AND INDICATORS

AIRSPEED INDICATOR

IAS - pointer is director reading from pointer and selected static system pressures. It is uncorrected for static errors.

Checkered Maximum Speed Pointer is operated by the static system and indicates the maximum operating speed V_{mo} or M_{mo}.

MACH METER

Direct reading from pitot and selected static systems pressures.

Supplies Mach information to KIFIS - Systems.

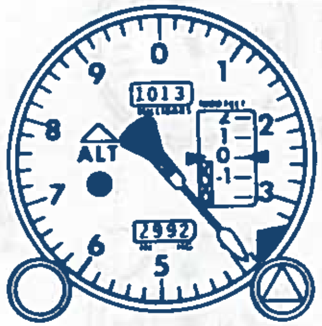
RADIO ALTIMETER

Indicates altitude above terrain. Fail flag monitors system or power failure, excessive terrain or attitude change. Rotating "Bug" is set by MDA set knob to applicable DH or MDA. Warning light, upper right hand corner will illuminate during descent when DH or MDA is reached as indicated by "Bug". Reset button upper left, is depressed to reset warning lights.

C1 - RADIO ALTIMETER - PILOT'S ESS A.C.

MDA WARNING LIGHT

Amber light illuminates when radio altimeter pointer reaches "Bug setting".



YELLOW DOT ALTIMETER

Direct reading from selected static system pressures. Corrected for static and instrument errors by KIFIS.

Right knob sets "Bug" for DH or MDA.

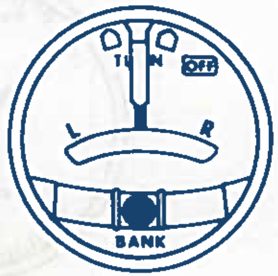
Left knob sets barometric pressure. Drum indicates thousands of feet, pointer indicates hundreds of feet.

White Chevron indicates power loss to KIFIS computer.

C11 - PILOTS AIR DATA. FLT. INST.
C11 - CO-PILOTS AIR DATA. FLT. INST.

RATE OF CLIMB INDICATOR

Direct reading from selected static system pressure.



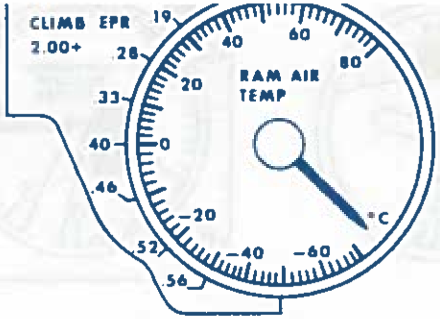
TURN & BANK INDICATOR

Turn indicator operated by electrically powered gyro. Bank indicator is conventional ball in liquid filled tube.

C11 - PILOTS TURN & BANK INDICATOR.
C11 - CO-PILOTS TURN & BANK INDICATOR.

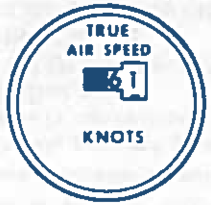
STATIC AIR TEMP

Static air temperature computed by KIFIS-1 system.
C11-PILOTS AIR DATA FLT INST.



RAM AIR TEMP INDICATOR

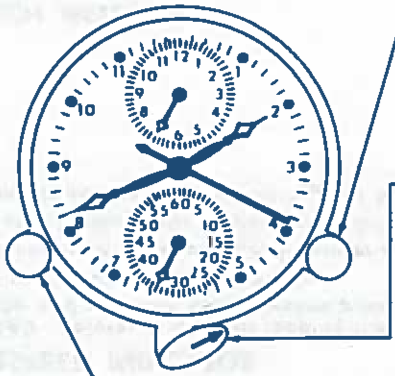
Derived from a temperature sensitive resistance bulb.
B4 - FREE AIR TEMP. IND.



TRUE AIRSPEED INDICATOR

True airspeed derived from KIFIS and temperature sensitive bulb.
C11-PILOT AIR DATA FLT INST.

FIRST OFFICER'S CLOCK



Operating the button returns the sweep second-hand and minute recording hand to zero and also starts and stops operating of the hands.

When the lever is rotated to point to the left, the elapsed time hands operate. When the lever is rotated to point to the right, the elapsed time hands stop. Further rotation to the right resets the hands.

Counter clockwise rotation of the button winds the clock. Setting is accomplished by pulling out on the button and rotating as required to indicate the correct time.

CAPT. & F/E CLOCK

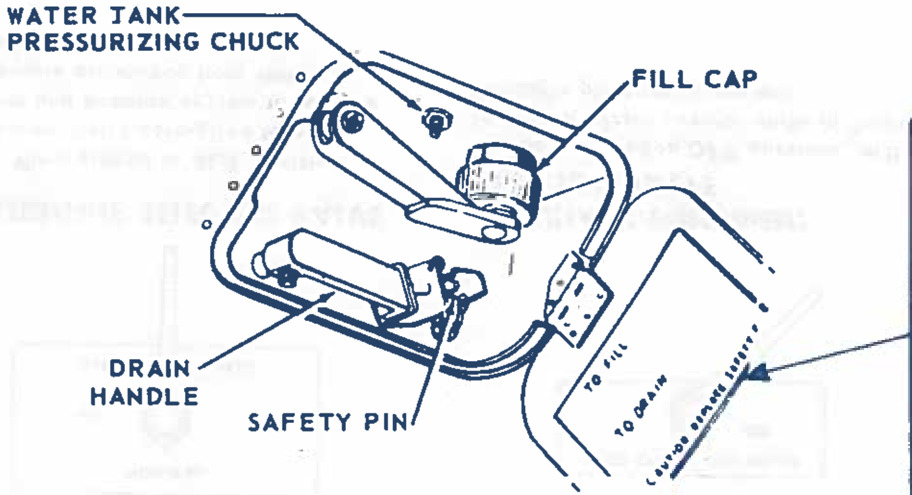
Standard 8-day clock. Counter clockwise rotation of the button will wind the clock.

Setting is accomplished by pulling out on the button and rotating as required to indicate the correct time.

STABILIZER POSITION INDICATOR

Indicates true position of horizontal stabilizer, as long as power is available to instrument.
C11 - STAB POS IND.

C. WATER SYSTEM CONTROLS



WATER SERVICE PANEL

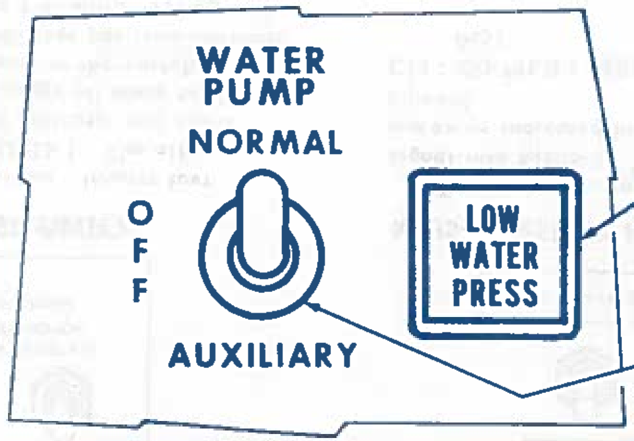
TO FILL

1. REMOVE FILL CAP.
2. RELEASE PRESSURE.
3. FILL TANK TO OVERFLOWING
4. SECURE FILL CAP.

TO DRAIN

1. RELEASE PRESSURE.
2. REMOVE SAFETY PIN ON DRAIN HANDLE.
3. AFTER DRAINING, REVERSE PROCESS.

CAUTION:
REPLACE SAFETY PIN.



WATER SYSTEM SWITCH AND LIGHT

LOW-PRESSURE WARNING LIGHT

Indicates low air pressure condition in water reservoir.

B3 - PASS WATER CONT & WARN.

WATER PUMP SWITCH

Turns on air pump if low air condition exists (auxiliary position not connected).

B3 - PASS WATER CONT & WARN.

KIFIS-1 TEST SWITCH

Test position - Inserts test signal into KIFIS-1. The altimeter, true airspeed indicator and static temperature gauge all move to the readings shown on the switch placard. Stabilizer position indicator will increase 1.6 units nose up and speed stability fail light will illuminate temporarily.

C11 - PILOT AIR DATA FLT INST.

KIFIS-2 TEST SWITCH

Test position - inserts a test signal into KIFIS-2. The altimeter moves as indicated by switch placard.

C11 - CO-PILOT AIR DATA FLT INST.

FLIGHT RECORDER SWITCH

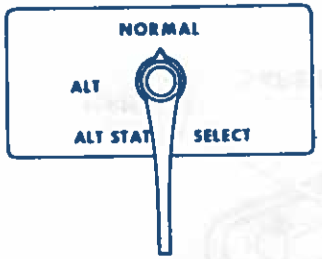
Controls operation of flight recorder unit in up position recording airspeed, vertical acceleration, altitude, time and heading.

C11 - FLIGHT REC.

FLIGHT RECORDER TEST SWITCH

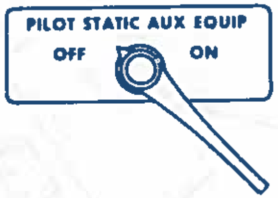
Audio monitoring provided by placing switch in TEST position, and listening for a "BEEP" sound in interphone system.

C11 - FLIGHT REC.



ALTERNATE SELECTOR VALVE

When placed in ALT position, removes static correction to altimeter and enables system to receive alternate air source from vertical stabilizer section.



AUXILIARY EQUIPMENT SELECTOR VALVE

When placed in OFF position, will isolate or affect several units in First Officer's pitot static system.

VMO-MMO TEST BUTTON

When depressed, intermittent bell will ring, testing mach-airspeed warning switch box contact.

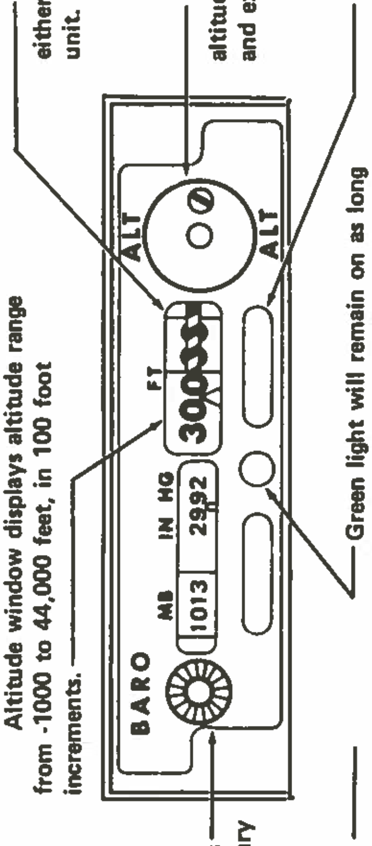
A7 - Vmo, Mmo WARN.

SPEED STABILITY FAIL LIGHT

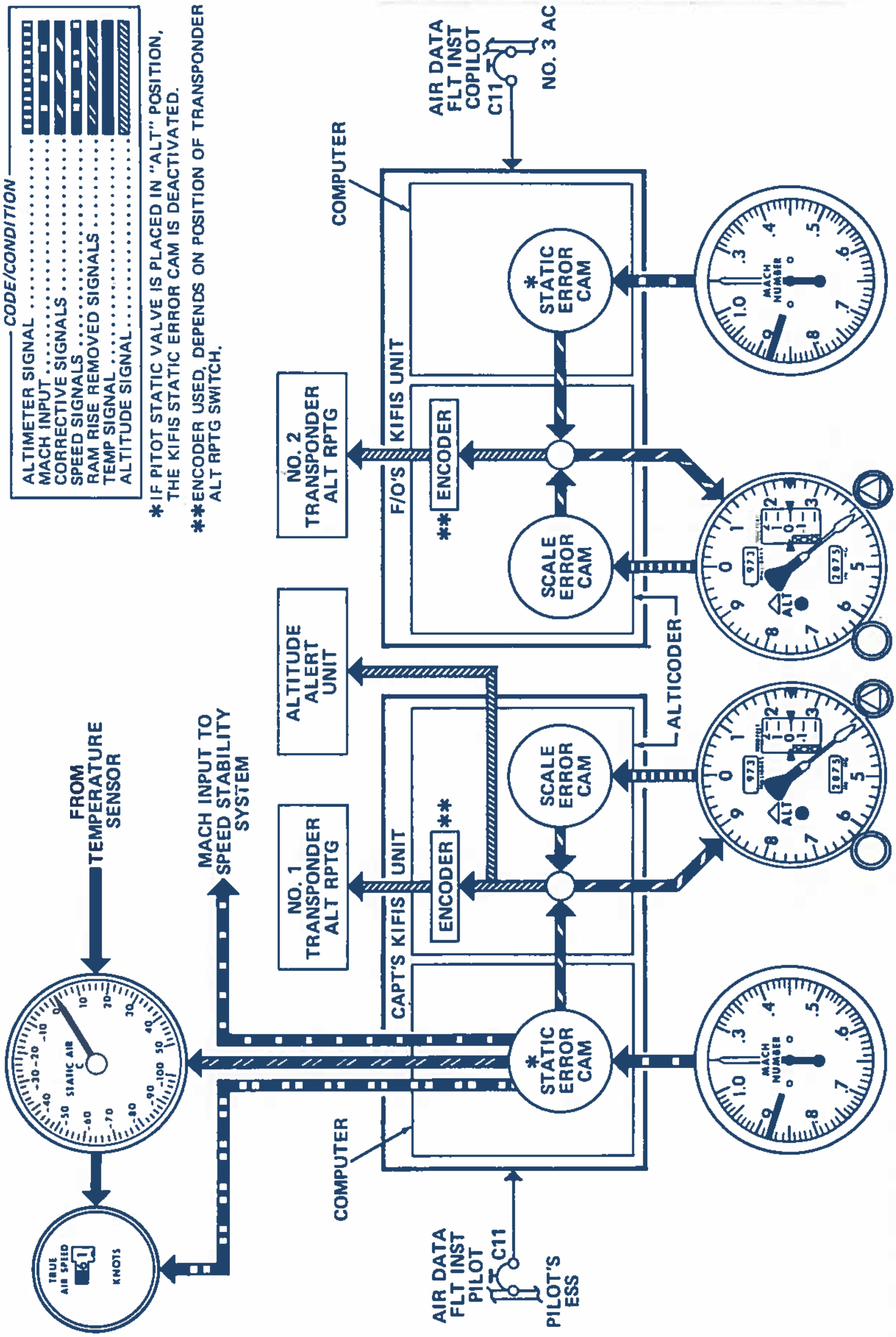
Red light will illuminate with power loss or if stabilizer does not have time to be repositioned due to excessive signals.

C11 - SPEED STAB.

ALTITUDE ALERT UNIT



A. KIFIS SYSTEM



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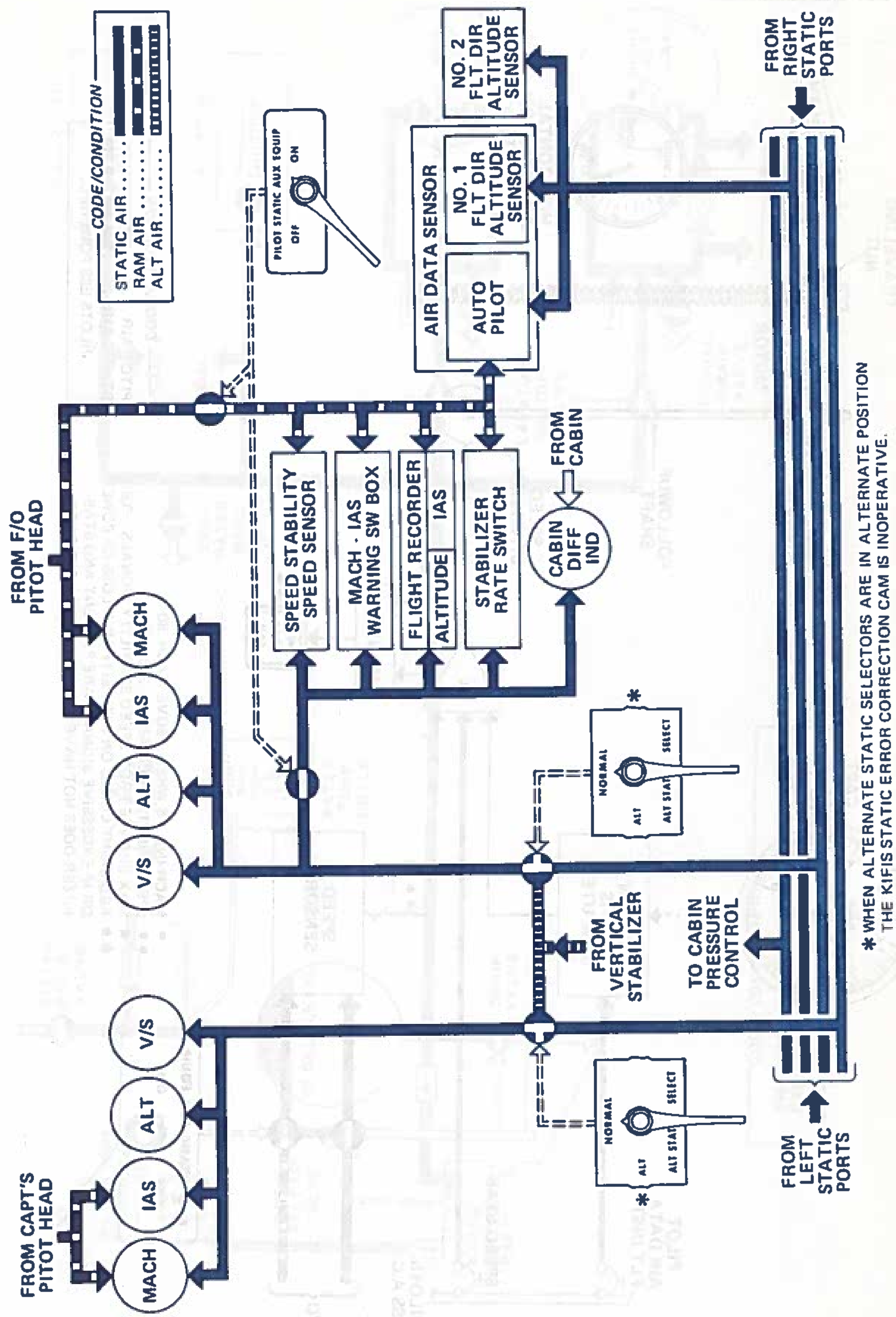
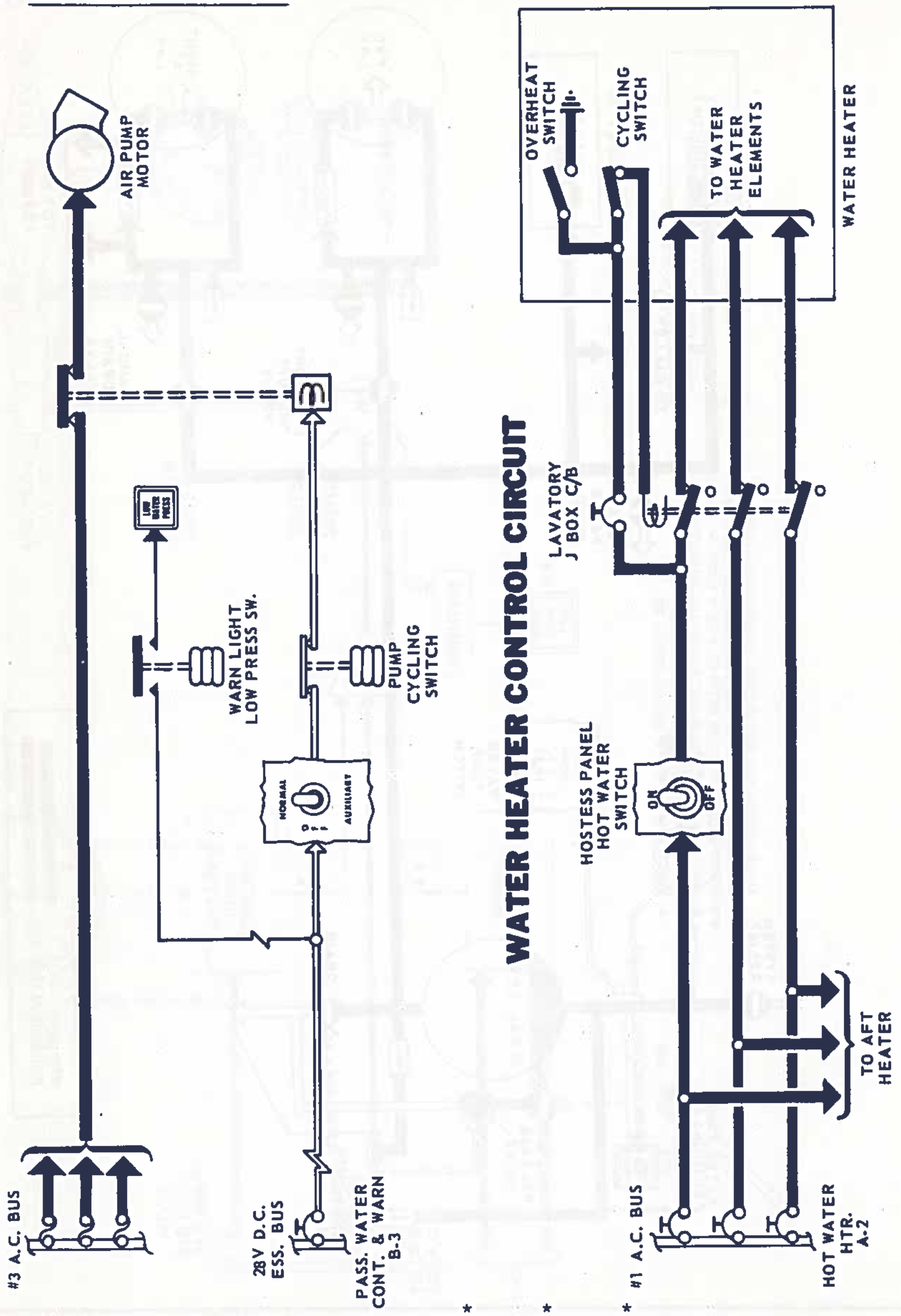
C. PITOT STATIC



F. WATER PUMP CONTROL CIRCUIT



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A. MISCELLANEOUS INSTRUMENTS

The miscellaneous navigation instruments are those instruments which are not directly associated with any specific navigation devices or systems. These instruments provide auxiliary sources of navigation data and include clocks, magnetic compass, turn-and-bank indicators, rate-of-climb indicators and ram air temperature indicator.

1. Clocks

The Captain's and Flight Engineer's clocks are standard 2 in. clocks as used in present equipment.

The First Officer's clock is a large 3 in. instrument with a sweep second-hand, a small minute dial and an elapsed time dial.

A button at the lower left edge of the clock is used to wind the clock, and to set the main indicating hands. Counter-clockwise rotation of the button winds the clock. Setting is accomplished by pulling out on the button and rotating as required to indicate the correct time.

A button at the lower right edge controls the sweep second-hand and the minute recording dial. Operating the button returns the sweep second-hand and minute recording hand to zero and also starts and stops operation of the hands.

The elapsed time clock, is controlled by a lever at the bottom of the clock, when the lever is rotated to point to the left, the elapsed time hands operate. When the lever is rotated to point to the right, the elapsed time hands stop. Further rotation to the right resets the hands.

2. Turn-And-Bank Indicators

Turn-and-bank indicators are on both Pilots' instrument panels. The turn indicator is operated by an electrically powered gyro, while the bank indicator is a conventional ball indicator in a curved, liquid filled tube. Operating power for the indicators is 115V, 400 cycles and is taken from two circuit breakers on the main C.B. panel. Operating power for the Captain's turn-and-bank indicator is from the Pilot's essential bus and operating power for the First Officers turn-and-bank is from the No. 3 bus.

An OFF warning flag is incorporated on the face of each indicator to warn the Pilots that electrical power has been interrupted.

3. Magnetic Compass

A standby magnetic compass is provided on the glare shield above the Pilots' instrument panel. This compass is so mounted that when it is not in use it may be stowed in the glare shield out of sight. When the flight crew wishes to use the instrument, it is simply lifted into line of vision above the glare shield.

A red light in the compass is operated by a variable control located on the First Officer's instrument panel. Power for the light is from the emergency D.C. bus through a MAG COMP LT circuit breaker on the "C" circuit breaker panel.

4. Rate-of-Climb Indicators

Rate-of-climb indicators are on both Pilots' instrument panels. These indicators are operated by static pressure applied to both the inside of the instrument case through an orifice and capillary, and the inside of a flexible diaphragm inside the case. As the aircraft changes altitude, the pressure inside the diaphragm changes more rapidly than the pressure inside the instrument case. The resulting differential pressure causes the diaphragm to expand or contract. The amount of expansion or contraction is proportional to the rate change of altitude and is indicated by a radial pointer in thousands of feet per minute.

5. Ram Air Temperature Indicator

Ram air temperature is displayed on a single indicator on the right of the center instrument panel. Temperature indications are derived from a temperature sensitive resistance bulb. The resistance of the bulb is proportional to the temperature at the sensitive surface and is displayed by the indicator as temperature in degrees centigrade (°C).

The temperature bulb is accessible from inside the lower nose section at fuselage station 245 on the right side. A second temperature bulb on the left side of fuselage at station 245 senses ram air temperature for the Integrated Air Data Instrument System (KIFIS).

Electrical power for operation of the ram air temperature indicator is from a 28V D.C. ram air temp. circuit breaker on the main C.B. panel.

B. MACH AIRSPEED WARNING SYSTEM

A mach airspeed warning system is provided to alert the flight crew when the aircraft reaches the V_{mo} or M_{mo} limits. An intermittant bell will ring when these limits are reached or exceeded. Checkered pointers on each airspeed indicator will provide visual indications of these limits. These pointers will indicate the V_{mo} limit until approximately FL230, then indicate the appropriate airspeed for M_{mo} when above FL 230. They should indicate approximately 370 at sea level, increasing to a maximum of approximately 390 at FL 230. They will decrease thereafter, if climb is continued.

The warning system consists of a pitot static operated switchbox assembly, a motor driven interrupter unit, and warning bell. A test button located on the captain's instrument panel checks the interrupter unit and bell.

Ram and static air, supplied from the first officer's pitot static system, causes two diaphragms within the switchbox assembly, to expand or contract with pressure changes. Switch contacts are set to close when the V_{mo} or M_{mo} limits are reached; the interrupter unit is energized; the intermittent bell will ring. Electrical power for this system is 28 volt emergency DC. Circuit breaker protection is provided on A-7 panel, and labeled V_{mo}-M_{mo} WARN.

C. PITOT STATIC SYSTEM

Measurement of total and static air pressure is accomplished through the pitot static system consisting of two pitot tubes, four pairs of static pressure ports and associated tubing. The pitot static system pressures are used in determining airspeed and mach number. Total and static pressures are also used by the auto pilot air data sensor, the mach airspeed warning switch, the flight recorder, speed stability "Q" transmitter, and the stabilizer rate control switch. Static pressure only is supplied to the rate-of-climb indicators, altimeters, the cabin differential indicator and to the cabin pressurization controls.

PITOT STATIC SYSTEM

Pitot pressure is supplied to the Captain's instruments from he left-hand pitot tube and pitot pressure to the First Officer's instruments is supplied from the right-hand pitot ube. The right-hand pitot tube also supplies pressure to the auxiliary equipment. A dual shutoff valve on the right aux instrument panel allows pressure to these auxiliary units to be shut off in case of leaks in the plumbing.

Static pressure is sensed through four static ports on each side of the fuselage connected in pairs. One pair of static ports are connected to instruments on the Captain's panel only. A second pair of static ports are connected to instruments on the First Officer's panel and also to most of the auxiliary equipment. The third set of static ports are connected to the Auto Pilot air data sensor and to the outflow valves. The fourth pair of static ports are connected to the cabin pressure control unit. An alternate static port is located inside the vertical stabilizer and is connected to two static selector valves, one located on each aux instrument panel. By placing either of these valves to the alternate position the units normally receiving static pressure from their respective ports will be connected to the static port inside the vertical stabilizer. Considerable errors can be expected on the respective instruments when selected to alternate static.

An aux. equipment shutoff valve located on the right-hand aux instrument panel will enable both pitot pressure from the right-hand pitot tube and static pressure from the second pair of static ports to be turned off in case of leaks in the plumbing. Placing this valve to the OFF position will deactivate the mach airspeed warning system, the stabilizer rate control switch, and the speed stability "Q" transmitter. Also the lack of pitot pressure to the auto pilot air data sensor will change the sensitivity of the auto pilot on altitude hold and preset heading functions. The flight recorder will be without both pitot and static pressures and the cabin differential indicator will lack static pressure.

FLIGHT RECORDER SYSTEM

The flight recorder system consists of a recorder unit enclosed in a fire resistant case and will record on a continuous length of aluminum foil tape compass heading, vertical acceleration, airspeed, pressure altitude and time markers. Compass information is supplied by the No. 1 polar path compass system, and pitot and static pressures are supplied by the First Officer's pitot tube and static ports. The recorder employs a clock-type mechanism, an aneroid type altimeter and an internal acceleration sensor. Operating power is 115V from the Pilot's essential bus and turned on by a switch type circuit breaker on "C" panel. Audio monitoring of the system is accomplished by a test switch on the Captain's side panel and listening for a 400 cycle "Beep" sound in the interphone system.

E. SPEED STABILITY SYSTEM

The speed stability system consists of an amplifier unit, an electric servo motor, a "Q" airspeed sensor, and a visual warning system. The purpose of the speed stability system is to make small changes to the stabilizer's position automatically so that all increases of airspeed or Mach will cause the nose of the aircraft to pitch up and a positive stick force will be felt. The airspeed signals are supplied by the "Q" sensor operated by the First Officer's pitot-static pressures. Mach signals are supplied by the Captain's KIFIS system however Mach information is only needed and supplied above Mach 0.80. The system is powered at all times but should only move the stabilizer when above 200 KTS as the "Q" signals are not available below that speed. The automatic trimming action caused by the speed stability system will be indicated in the cockpit by movement of the stabilizer position indicator and the trim wheel will not move. The maximum amount that the speed stability system can move the stabilizer is limited to 3.8 degrees by mechanical stops. Testing the Captain's KIFIS test switch will cause the stabilizer to move 1.6 degrees as the results of Mach signal changes. A SPEED STAB FAIL light on the Captain's instrument panel will warn the crew that power is lost to the system or that the stabilizer is not in the position being called for by the Mach or airspeed signals. Operating power is from the Pilot's essential bus with circuit protection on the "C" circuit breaker panel.

F. KIFIS

The main purpose of KIFIS (Kollsman Integrated Flight Instrument System) is to correct the barometric altimeters for scale and static errors. A common control chassis, located in the electrical compartment, contains individual computers, alticoders and amplifiers for each pilot's system. Each computer contains a motor driven static error cam, and each alticoder contains a motor driven scale error cam and an encoder.

Each scale error cam is calibrated and matched with an altimeter. It provides correction for mechanical or calibration errors inherent for that altimeter. This is accomplished by adjusting screws, located around the outer surface of the cam, for specific altitude intervals. Each static error cam compensates for errors in the static pressure system. These errors are due to the location of the static ports and aerodynamic flow of air over the ports, causing a burbling effect. The altimeter receives a combined correction signal from both correction cams and this results in a more accurate altimeter at the higher altitudes. Each encoder provides corrected altitude signals to whichever transponder is selected by the respective altitude reporting switch.

Captain's KIFIS not only corrects his altimeter, but also sends inputs to the SAT and TAS. The static air temperature indicator receives a temperature signal (OAT) from a temperature sensing bulb on the left side of the aircraft, and a ram rise removed signal from the computer. A temperature correction chart is provided in the FHB 07.01 section, because the ram rise effects are not completely removed. The true airspeed indicator requires a temperature signal from SAT and a speed signal from the computer. When above mach .80, captain's KIFIS sends a mach signal to the speed stability amplifier to assist in preventing "tuck under" tendencies. The altitude alert unit receives a corrected altitude signal from the captain's alticoder, so that proper light and beep tone indication is available to the pilots as a reminder of their pre-selected altitude.

KIFIS

KIFIS test switches are provided to check instrument test indications and tolerances. Each altimeter will normally increase 350 ± 50 feet during this test. If the altimeter only increases 200 feet, the position of the pitot static ALT SEL valve should be verified. If this valve is in any position other than NORMAL, the respective KIFIS static error cam is deactivated and the altimeter would only increase 200 feet. At the higher airport elevations (approximately 5000 feet) the altimeters will not necessarily be within the desired tolerance during this check. When the captain tests his KIFIS the auxiliary hydraulic pump should be turned on because of stabilizer movement. The horizontal stabilizer will normally increase 1.6 degrees during his check because a mach .92 signal is sent to the speed stability amplifier.

Electrical power required by captain's KIFIS is from the pilot's essential AC bus. Electrical power required by the first officer's KIFIS is from the #3 AC bus. Circuit breaker protection is provided on C-11 panel and labeled PILOT & CO-PILOT AIR DATA FLT INST. An indication of power failure is either a white chevron or white triangle appearing on the respective altimeter. If power fails to captain's KIFIS, TAS and SAT will remain at their last indication, and a fail flag will appear on the altitude alert unit. Altimeters will continue to function with a KIFIS power failure, however without correction.

RADIO ALTIMETERS

A dual indicator, single radio altimeter system is provided, displaying height above ground information.

The system consists of dual indicators, transceiver, MDA lights and antennas for receiving and transmitting.

The captain's indicator is the master indicator, receiving signals and power directly from the transceiver. The first officer's indicator is a repeat indicator, and is wired to operate as a part of the installed signal system.

Each indicator contains a servo driven pointer, amplifier, MDA SET knob, reset button and MDA lights. An MDA cursor or bug, can be set at the appropriate DH or MDA. This range is from -20 to 500 feet. The MDA light on the indicator and the MDA light above the barometric altimeter will illuminate when the respective pointer reaches its bug setting, during the approach. Depressing the reset button will extinguish the lights.

Electrical power for the system is taken from the pilots' essential bus (115 V. AC), controlled by the ESSENTIAL radio switch. Circuit breaker protection is provided by the #1 Radio Altimeter breaker on C-1 panel.

The transceiver contains an integrity monitor which will deactivate the system, causing the fail flags to appear under abnormal conditions. The following parameters are monitored:

- Captain's indicator
- Electrical power
- Altitude integrity (excessive terrain and attitude changes)
- Antenna coupling integrity
- Signal strength integrity

WATER SYSTEM

A shutoff valve is provided for each galley and the forward lavatory, with one valve provided for the two aft lavatories. The forward lavatory valve is located at a point where the supply line enters the lavatory wash basin cabinet. The single shutoff valve for the aft lavatories is located below the water heater in the left lavatory. The galley shutoff valves are located near the floor in the base of each galley and are accessible by removing the lower outboard food storage cabinet.

WATER HEATERS

All water heaters have three heater elements. Each element operates on single-phase AC power and is so wired that in the event one element malfunctions, the remaining two will continue to operate.

The lavatory water temperature is controlled by a 49°C thermal cycling switch with a 63°C overheat thermal switch and junction box circuit breaker in series as a safety device. The overheat switch will close when the water temperature exceeds 63°C. This will cause the circuit breaker to trip deactivating the heater. (Unmodified aircraft do not have the lavatory J box circuit breaker.)

Operation of the galley water heaters is controlled by a two-position ON-OFF switch located on each coffee maker unit. Water temperature is maintained at 85°C through the use of a thermal switch. An overheat thermal switch is also provided to cut off heating power at 99°C should the 85°C switch fail to operate. Circuit protection is provided by a 30A current limiter in each phase to the galleys and a 10A current limiter in each phase to the heaters. The 10A current limiters are located behind the galley switch panel.

WATER COOLERS

Two thermo-electric water coolers are installed in the #2 and #4 galleys. These units replace the previously installed dry ice units.

The units will cool the water to a minimum of 37°F. A low temperature switch will remove power from the thermo-electric modules at this temperature but the cooling fan will operate continuously.

Electrical power to the thermo-electric units is from the coffee maker circuit and they will operate anytime the coffee maker circuit breakers are closed and galley power is on. The units are individually protected by three 1 ampere fuses located on the top of the cooler. A green operating indicator light located on the top of the unit will be on during normal operation.

Cooling air for these units is vented through the upper storage compartments of the respective galleys. If these compartments are completely filled with supplies, cooling airflow is reduced and can cause the water cooler unit to overheat and the storage area to become quite hot. Plastic items should not be stored in these compartments as the temperature can become high enough to melt them although this would not be hot enough to create a fire hazard.

LET SYSTEM

: toilet is mounted on top of the toilet sump tank with its er surface attached to the lavatory panel. The aft toilet ıp tanks have a capacity of 20 gallons each and the forward et sump tanks have a capacity of 30 gallons.

ɪVICE PANELS
let system service panels are provided on the exterior of aircraft for servicing and flushing the toilet system on the und.

: forward service panel is installed on the left side of the elage directly beneath the forward entrance door. It in-porates a drain valve pull handle, a capped flushing line ing and a capped drain line.

: aft service panel is installed on the bottom center line of fuselage at station 1331. The aft service panel is similar he forward service panel except it incorporates two capped shing line fittings, one for each lavatory. The drain valve l handle operates both drain valves and the drain lines join ether at the single outlet.

lue-green degerm agent is used in servicing the toilet sump ks. Because of the corrosive agents carried by this solution, leakage around the service panel area must be investigated.

TITUDE ALERT SYSTEM

.s system is designed to alert the pilots when approaching, ching and/or departing a pre-selected altitude. This is omplished by visual and aural signals.

: amber, green and red lights provide the visual signals. eeptone is provided, through the overhead cockpit speaker. : aural signal volume is pre-set, and approximately one ond in duration.

: alert unit requires the captain's KIFIS for altitude signals. ots Essential AC bus powers a 28 volt transformer, which in n power's the alert unit. Circuit breaker protection is pro-ed on B5 panel.

ght and beep tone signals are the same whether approaching l/or departing from above or below a pre-selected altitude. : alert signals are activated at the points listed below:

Approaching selected altitude by:

1000'. . . . . Amber light
500'. . . . . Beep tone
250'. . . . . Green light

Departing selected altitude by:

250'. . . . . Beep tone
500'. . . . . Flashing red light

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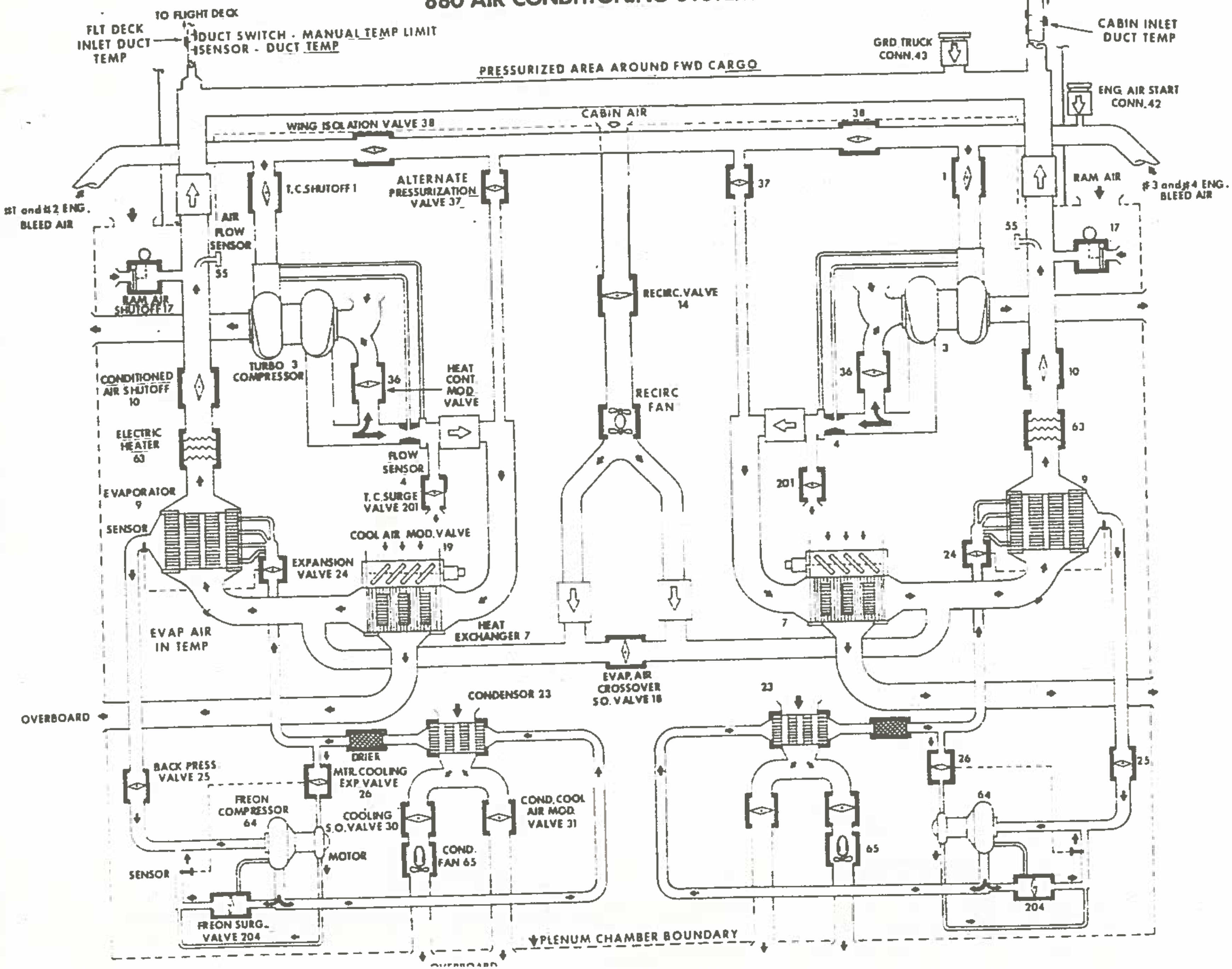
880 AIR CONDITIONING SYSTEM

880-8--2311
6/6/63



A. SINGLE TURBOCOMPRESSOR AVAILABLE

The following procedure is recommended when operating with only one turbocompressor.

1. Operative Turbocompressor . . . ON
2. Equipment Cooling Switch . . . FAN ON
   This turns on the equipment cooling fan and closes the equipment cooling valve to conserve pressurization air.
3. Recirc Fan . . . ON
   This provides additional air flow necessary for passenger comfort.
   In flight an Alternate Pressure Source may be used instead of the Recirc Fan if desired.

B. TURBOCOMPRESSOR RPM EXCESSIVE

This procedure assumes that only one turbocompressor RPM is excessive.

When a turbocompressor RPM exceeds normal maximum and reaches 51,000 RPM, proceed as follows:

1. Overspeeding Turbocompressor . . . OFF
2. Correct for loss of pressurization air by either of the following:
   a. Equipment Cooling Switch . . . FAN ON
   b. Alternate Pressure Source . . . OPEN

C. TURBOCOMPRESSOR OVERSPEED TRIP LIGHT ON

This procedure assumes that both turbocompressors were being used prior to one overspeed trip light coming ON. When this occurs the turbocompressor is automatically shut off and cannot be restarted in flight. To correct for the loss of turbocompressor airflow, proceed as follows:

1. Use either of the following:
   a. Equipment Cooling Switch . . . FAN ON
   b. Alternate Pressure Source . . . OPEN
2. Turbocompressor Switch . . . OFF
   Turn OFF the tripped turbocompressor switch to prevent an immediate restart when the unit is reset on the ground.

D. ALTERNATE PRESSURE SOURCE USE

Alternate Pressure Source air may be used any time in flight if the EVAP AIR IN temperature can be kept below 140°F. The most probable time for it to be used is when a turbocompressor is inoperative.

1. This procedure assumes no malfunction exists in either Freon system or the temperature control system on the affected side. Unless immediate airflow is needed for pressurization accomplish the following procedure in the order listed or smoke may be generated by the system.
   a. Temperature Selector Switch . . . MAN
      This provides direct control of the temperature regulating units.
   b. Manual Temperature Control Switch . . . Toggle COLD for 20 seconds or until the Freon Run light comes ON.
      This ensures the Alternate Pressure air will be cooled by positioning the temperature regulating units to cold. Failure to accomplish this step before opening the Alternate Pressure Source may result in smoke entering the aircraft.
   c. Alternate Pressure Source Switch . . . OPEN
      This provides pressurization air direct from the bleed air manifold. Control temperature manually on the respective side as long as Alternate Pressure Source is in use. Make any necessary changes in small increments, until desired temperature is obtained. Keep EVAP AIR IN temperature below 140°F to prevent generation of smoke.
2. This procedure should be used when manual temperature control is inoperative.

   Unless immediate airflow is needed for pressurization accomplish the following before opening the Alternate Pressure Source.

   a. Temperature Selector Switch . . . AUTO
   b. Temperature Selector Rheostat . . . Full Cold
   c. When Freon Run light ON
   d. Alternate Pressure Source . . . OPEN

   Adjust temperature as required on the affected side. Make adjustments in small increments while closely monitoring EVAP AIR IN temperature on the respective side.

E. ELECTRIC CONTROL OF PRESSURIZATION

The pressure regulator switches may be used as a normal means of controlling cabin pressure. The switches directly control each pressure regulator valve. This makes it possible to regulate cabin pressure at any time except when the automatic controller is holding maximum differential. The most probable time to control pressurization electrically is when the automatic controller malfunctions.

During electrical control either pressure regulator valve will serve as a positive pressure or negative pressure relief.

1. To control pressurization electrically proceed as follows:
   a. Pressure Regulator Switches . . . BOTH OFF
   b. Pressure Regulator Switches . . . Toggle OPEN or CLOSE as required.
      Toggle both switches together until a rate of change is indicated. This may not occur immediately since the actuator must first move until it contacts the valve. As soon as a change is indicated toggle one switch at a time for 1 or 2 seconds, then wait a few seconds for response. ~~Do not exceed a differential of 7.8 PSI.~~
2. To return to automatic operation from electric control, use the following procedure. This assumes that electric control was used for instructional purposes and no malfunction exists in the automatic controller.
   a. Select existing cabin altitude on the automatic controller.

ELECTRIC CONTROL OF PRESSURIZATION

b. Toggle pressure regulator switches to AUTO.
This positions the actuators so the valves can be controlled by the automatic controller.

3. Comply with the following conditions if dispatched with one pressure regulator automatically inoperative and electrically closed.

a. Ensure valve circuit breaker is IN.
This permits the valve to remain electrically capable of operating as a relief.

b. Do not exceed a differential of 7.8 PSI.
This is to prevent the closed valve from relieving electrically and causing a rapid change in cabin altitude.

CABIN HAS HIGH CLIMB RATE AND ONE PRESSURE REGULATOR CLOSED LIGHT ON

With the pressure Regulator switches in AUTO if either gear safety switch assumes an "On-Ground" position the affected pressure regulator valve will open electrically. This will cause an exceptionally high cabin climb rate even though the other valve goes closed. If this condition is not corrected, the cabin will depressurize completely.

1. To stop the loss of pressure, proceed as follows:

a. Switch for Open Pressure Regulator . . . CLOSE
Hold the affected pressure regulator switch to CLOSE until the cabin rate of climb drops to a comfortable value. This may require as long as 15 seconds because of the time required for the jackscrew to contact the outflow valve poppet. Then toggle to CLOSE as required to regulate cabin pressure.

If cabin differential pressure has been above 8.1 psi, manual control may not be possible until the differential pressure drops below approximately 7 psi.

b. When cabin pressure stabilized . . . Pressure Regulator switch OFF.
Unless needed to regulate pressure, leave the affected switch Off until after landing. After landing return the switch to AUTO so that valve will be opened. Do not return the switch to AUTO in flight.

2. The following may be used to determine which safety switch has failed.

a. The right safety switch is at fault if the Fwd pressure regulator CLOSED light came On and the Aft pressure regulator switch was used to control pressurization.

b. The left safety switch is at fault if the Aft pressure regulator CLOSED light came on and the Fwd pressure regulator switch was used to control pressurization.

G. RAM AIR SOURCE (AUXILIARY VENTILATION)

1. PRESSURE REGULATORS . . . OPEN

2. RAM AIR SOURCE . . . OPEN

3. EQUIP. COOL . . . FAN ON

4. RECIRC. FAN . . . As required.

Entrance of ram air depends upon ram pressure exceeding duct pressure. With either turbocompressor operating, no ram air will enter. With the Recirc Fan On, ram air entry will be reduced at high speed and stopped at low speed. Conditioning of ram air is not possible and recirculated ram air can only be refrigerated.

Cabin altitude can be lowered some, due to the pressurizing effect of ram air, by toggling the pressure regulators toward closed.

H. FREON FAIL LIGHT ON

The FREON RUN light will go out momentarily as the FREON FAIL light comes on. However, as soon as the Freon back pressure valve has time to run closed, the Freon run light will come back on. It will remain on as long as sequencing device is calling for Freon and the switches are positioned for that Freon to operate.

1. In taxi or early climb, make one reset attempt:

Freon Reset Switch located on lower inboard corner of circuit breaker panel "C."

The Freon Fail and Run lights will both go out while the Reset switch is being actuated.

2. If the Freon resets, the Fail light will remain out as the switch is released and the starting electrical loads will become evident.

The run light will remain on as long as energizing power is getting to the compressor relay whether or not the lock-out relay resets, the Freon compressor relay operates or the Freon compressor actually starts.

3. If Freon Fail light comes back on, three more reset attempts may be made as in step 1 after waiting:

5 minutes for second attempt.
10 minutes for third attempt.
15 minutes for fourth attempt.

4. If the Freon trips repeatedly, and the other pack is operating properly, place the Freon Selector switch to FLT. DECK OFF or CABIN OFF as necessary to send all the air from both turbocompressors through the operative system. This gives maximum cooling from one operative unit. However, both compartments receive the same temperature air.

FLT. DECK OFF or CABIN OFF also deactivates the respective automatic temperature control and turns out the FREON RUN light. The FREON FAIL light will remain on until turned out by the reset switch.

The heat exchanger cool air mod valve is still controllable by the MANUAL TEMP. CONTROL switch and should be driven full cold to decrease the load on the operative Freon system.

The RECIRC. FAN should not be used when the Freon Selector switch is out of the BOTH ON position as it would be pumping against turbocompressor pressure and overheating of the fan motor is possible.

5. If it is impossible to cool the air from both turbocompressors with one Freon, proceed as follows:

a. T/C on failed side . . . OFF

FREON FAIL LIGHT ON

EQUIP. COOLING SWITCH . . . FAN ON

If recirc. fan is desired:
FREON SELECTOR . . . BOTH ON

RECIRC FAN . . . ON
Recirculated air through the failed system will get no cooling but greater comfort may be attained by increasing the air flow.

If the FREON RUN light goes out on the operative Freon, this indicates that primary cooling is adequate. The following procedure can be used, if desired.

FREON SELECTOR . . . BOTH ON

Both T/C's . . . BOTH ON

RECIRC. FAN . . . OFF

FREON RUN LIGHT CYCLING IN STABILIZED CRUISE

The Freon compressor motor is started by the sequencing device before the cool air mod valve reaches its full cold position. If temperature requirements are being satisfied by mod valve operation in this range, the Freon Run light may cycle on and off due to slight changes in sequencing device position. Alternate starting and stopping of the compressor motor causes unnecessary wear on the unit.

When such cycling occurs, place the Freon Pack switch off until the inlet duct temperature indicates a need for Freon cooling.

Cabin temperature should be checked at start of descent to insure sufficient cooling is available as ambient temperature normally increases during descent.

FREON BACK PRESSURE VALVE OPEN CHECK

The following procedure can be used to determine the extent a Freon back pressure valve is open when in the operating range.

Turn Freon Pack switch off and back on. The Freon Run light will go out.

Note the period of time before the Freon Run light comes back on. This indicates the time required for the back pressure valve to run closed.

A 20 second delay means the valve was fully open.

A lesser time indicates the valve was open a proportionately less amount.

If the Run light comes on immediately, either the valve is fully closed or the back pressure valve switch has been bypassed.

Air conditioning panel should be placarded if the switch is bypassed.

Each Freon system has an 8 second time delay so the compressor starting load will not be evident until the end of 8 seconds after the Freon Run light comes back on. If the condenser fan operation is called for, the condenser fan starting load will occur as the Freon Pack switch is turned back on.

MANUAL TEMPERATURE CONTROL

If the temperature selected on the Cabin or Flight Deck automatic temperature control is not maintained or if a system fails to respond to a change in temperature selection when in AUTO, proceed as follows:

Temperature Control Selector . . . Manual

Temperature Indicator Selector . . . Duct

Duct Temp. Selector . . . Inlet Duct

Toggle MAN HOT or MAN COLD as necessary.

Monitor Inlet Duct temperature to prevent too great a temperature change.

Caution must be observed when operating the system in Manual as the cool air mod valve and the sequencing device are operating in parallel so temperature changes may occur at double the normal rate.

Proper operation of the cool mod valve can be verified by selecting EVAP AIR IN and watching for a temperature change as a manual selection is made.

Temperature difference between EVAP AIR IN and INLET DUCT position represents the amount of temperature change by the Freon system or electric heaters, whichever is on.

RECIRC FAN USE

Do not use the recirc fan in flight with the cabin pressurized under the following conditions:

Two pressurization sources in use.

Freon Selector switch in Cabin Off or Flight Deck Off.

When maximum cooling is desired while on the ground with one Freon system inoperative, the following procedure can be used:

Select Cabin Off or Flight Deck Off as applicable and turn recirc fan on.

If neither Freon system can be used because of an inadequate power cart or inoperative Freon system, the recirc fan should be used only if it will improve passenger comfort. A running recirc fan adds some heat to the air it is moving so continuous recirculation without some Freon cooling while on the ground may add to passenger's discomfort. Under these conditions the following appropriate procedure should be used:

Cabin cooler than outside air - Conserve residual cool air by leaving the recirculation fan off and keeping the cabin and cockpit doors closed as much as practical.

Cabin warmer than outside air - Keep the cabin and cockpit doors and the cockpit windows open to permit a maximum exchange of air. Leave the recirculation fan off or use only intermittently.

ECIRC FAN INOPERATIVE

motor overheat or phase unbalance will cause a trip which equires ground reset.

or taxiing with recirc fan inoperative, use either or both /C as desired.

weather is warm, the corresponding Freon system should on to cool the turbocompressor air.

NCONTROLLABLE INCREASE OF CABIN PRESSURE

cabin pressure is increasing and attempts to limit it sing pressurization controls are not effective, consider e following corrective actions.

urn OFF one air source and monitor cabin pressure. his will reduce airflow into the aircraft.

lace the equipment cooling switch to Valve Open. This pens the equipment cooling valve and ports some pres- urization air overboard.

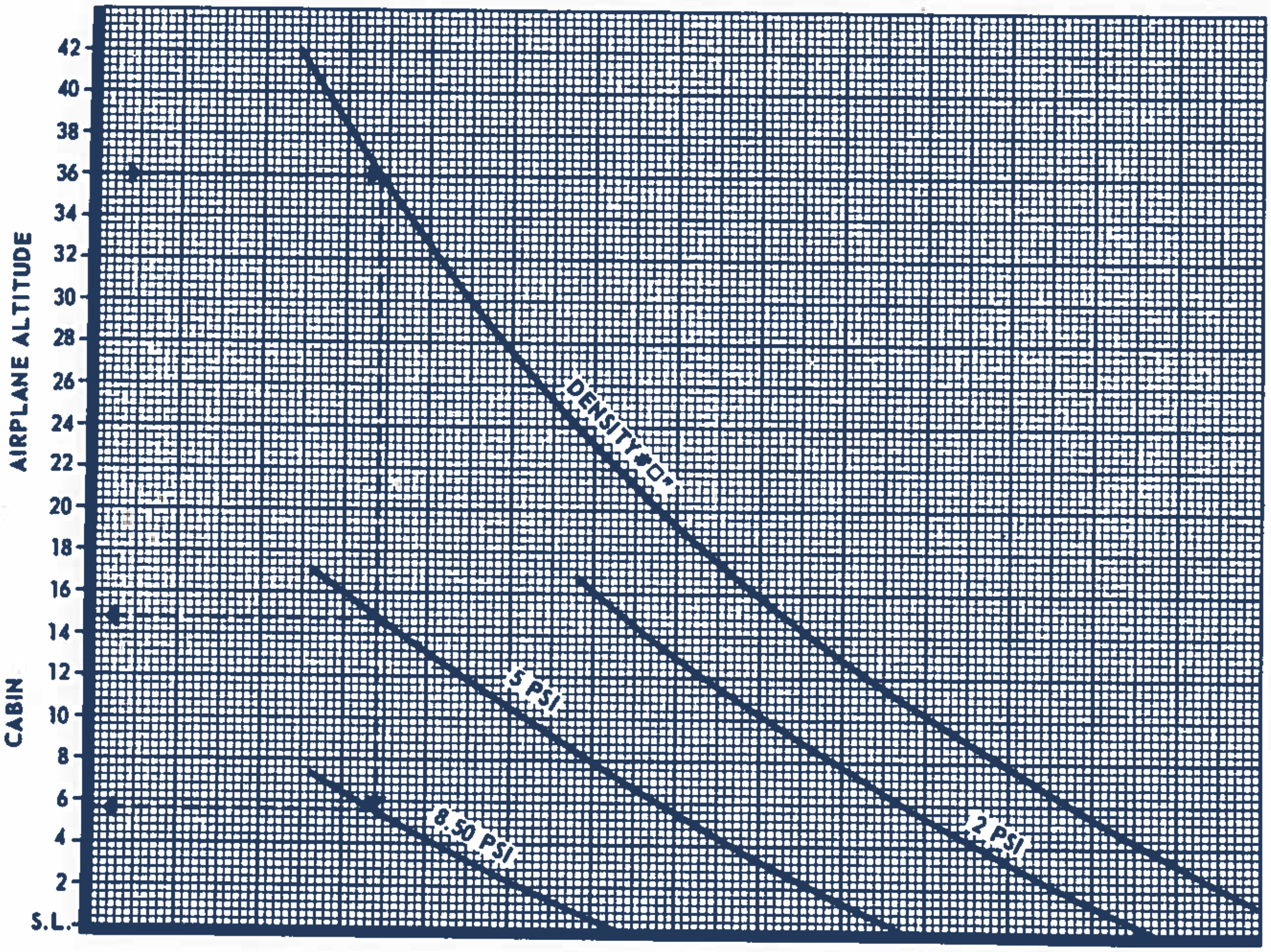
urn OFF the other air source if cabin pressure continues increase uncontrollably. This stops the remaining irflow into the aircraft. Take all necessary steps for npressurized flight.

nsure the aircraft is unpressurized prior to landing. his will prevent a large pressure surge from occurring fter landing and makes it possible for the doors to be pened.

P. CABIN ALTITUDE/DIFFERENTIAL PRESSURE CHART

CABIN ALTIMETER
OR DIFFERENTIAL PRESSURE GAUGE IS INOPERATIVE

1. TO DETERMINE CABIN ALTITUDE WHEN CABIN DIFFERENTIAL PRESSURE IS KNOWN:
   a. Enter chart from left at existing AIRPLANE ALTITUDE.
   b. Continue right to DENSITY line.
   c. Go down to indicated differential (PSI) line.
   d. Go left to find CABIN existing altitude.
2. TO DETERMINE CABIN DIFFERENTIAL PRESSURE WHEN CABIN ALTITUDE IS KNOWN:
   a. Enter chart from left at existing AIRPLANE ALTITUDE.
   b. Continue right to DENSITY line.
   c. Go down to intersect a line projected to right from the indicated CABIN altitude.
   d. This intersecting point is the existing cabin differential pressure.



A. AIR SOURCE CONTROLS AND INDICATORS

TURBOCOMPRESSOR RPM INDICATOR

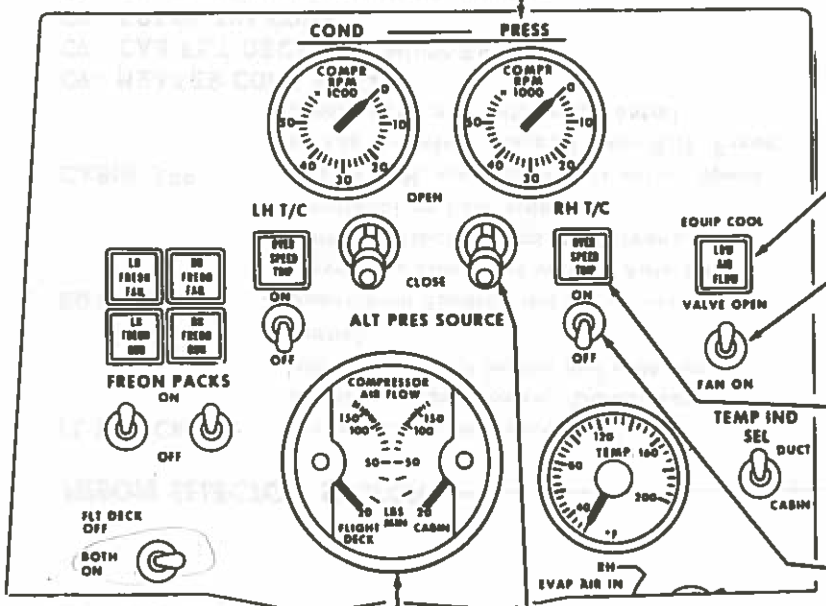
Indicates turbocompressor RPM.
C10 - TURBO COMPR IND, CABIN & FLT DECK.

EQUIPMENT COOLING LOW AIR FLOW LIGHT

Indicates air flow over electronic units is less than required for proper cooling.
C10 - CABIN ALT WARN LT.

EQUIPMENT COOLING CONTROL SWITCH

VALVE OPEN - Opens valve in equipment cooling duct and stops equipment cooling fan.
FAN ON - Closes valve in equipment cooling duct and starts equipment cooling fan.
C6 - ELEC COOLING VALVE.
B3 - ELEC COMPT FAN CONT.



TURBOCOMPRESSOR OVERSPEED TRIP INDICATOR LIGHT

Indicates turbo has shut down by the overspeed protection system.
C10 - TURBO COMPR ON.

TURBOCOMPRESSOR CONTROL

ON - Arms open solenoid in T/C shutoff valve.
OFF - Arms closed solenoid in T/C shutoff valve. Valve is opened and closed by air pressure.
C10 - TURBO COMPR OFF: TURBO COMPR ON, CABIN & FLT DECK.

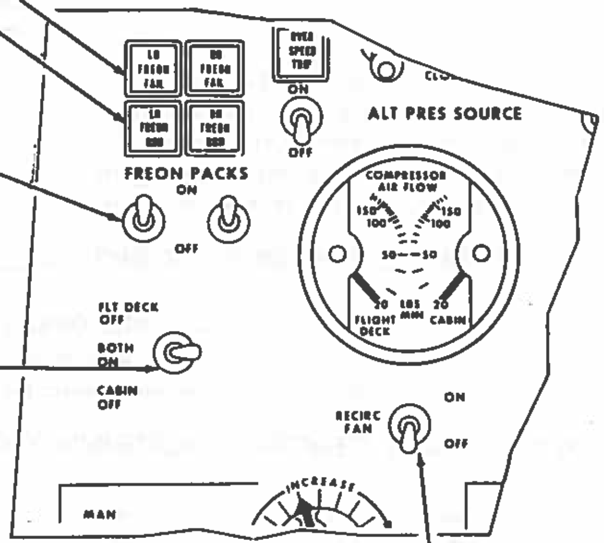
COMPRESSOR AIRFLOW INDICATOR

Indicates airflow through cabin and flight deck air conditioning systems.
C9 - AIRFLOW IND.

ALTERNATE PRESSURE SOURCE CONTROL SWITCH

OPEN - Arms valve electrically. Air pressure opens valve.
CLOSE - Removes electrical power and valve is closed by spring force.
C10 - EMER PRESS, CABIN & FLT DECK.

. FREON SYSTEM CONTROLS AND INDICATORS



FREON RUN LIGHT

Indicates Freon system operation is selected by the sequencing device.

C8 - FREON SYS CONT

FREON PACK SWITCHES

ON - Arms Freon system for operation by sequencing device.

OFF - Stops Freon system operation.

C8 - FREON SYS CONT

FREON SELECTOR SWITCH

FLT DECK OFF - Closes L.H. conditioned air valve, opens crossover valve. De-activates left Freon, elect heater and auto temp control.

BOTH ON - Opens both conditioned air valves and closes the crossover valve. Auto temp controls, elect heaters and Freons are functional on both sides.

CABIN OFF - Closes R.H. conditioned air valve, opens crossover valve. De-activates R.H. Freon, elect heater and auto temp control.

C9 - HEATER CONT RELAY
C9 - CAB FLT DECK AIR SHUTOFF
C8 - FREON SYS CONT
C9 - EVAP AIR MANF SHUTOFF VALVE

FREON FAIL LIGHT

Indicates the Freon system has automatically shut down by it's trip circuit.

C8 - FREON SYS CONT

RECIRCULATION FAN SWITCH

ON - Opens recirc valve and fan starts after valve is open.

OFF - Closes recirc valve and stops fan.

VALVE C9 - ELECT TEMP CONTROL - CABIN
FAN C9 - RECIRC FAN CONT

(5011)

C. TEMPERATURE CONTROLS AND INDICATOR

TEMPERATURE INDICATOR

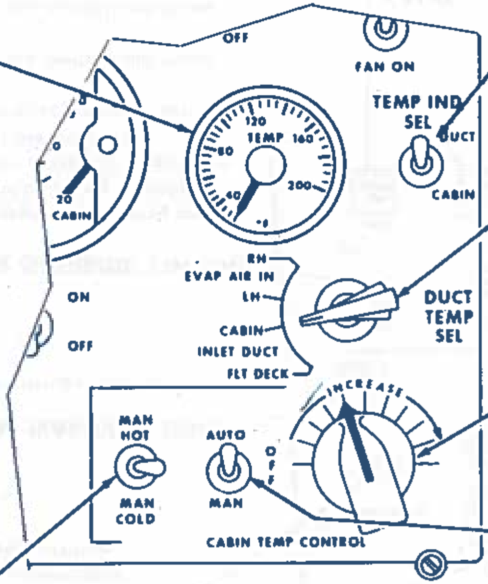
Indicates cabin air out temperature or duct temperature, as selected.
B4 - CAB AIR TEMP.

TEMPERATURE INDICATOR SELECTOR SWITCH

Connects indicator to cabin temp sensor or duct temperature selector.
B4 - CAB AIR TEMP.

DUCT TEMEPERATURE SELECTOR

Connects indicator to evaporator air in or inlet duct temp sensors through the indicator selector.
B4 - CAB AIR TEMP.



AUTOMATIC TEMPERATURE SELECTOR

Selects desired temperature during automatic temperature control.
C9 - ELEC TEMP CONTROL

AUTO-MANUAL SELECTOR SWITCH

AUTO - Permits the automatic system to control temperature as selected.
OFF - Deactivates the auto and manual temperature control systems.
MANUAL - Permits controls of all temperature controlling devices manually by use-on the manual control switch.

C9 - ELEC TEMP CONTROL.

MANUAL TEMPERATURE CONTROL SWITCH

Provides temperature control signals to the sequencing device and cool air mod valve.
C9 - ELEC TEMP CONTROL

PRESSURIZATION CONTROLS AND INDICATORS

AUTOMATIC CABIN PRESSURE CONTROL UNIT

Pneumatically positions the outflow valves to automatically obtain and maintain cabin pressure as selected (pressure regulator switches in AUTO).

CABIN ALTIMETER

ALTITUDE HORN CUTOUT SWITCH

Push button silences intermittent horn which blows when cabin altitude becomes excessive.
C10 - CABIN ALT WARN LT.

CABIN HIGH ALTITUDE WARNING LIGHT

Indicates when cabin altitude reaches approximately 10,000 feet.
C10 - CABIN ALT WARN LT.

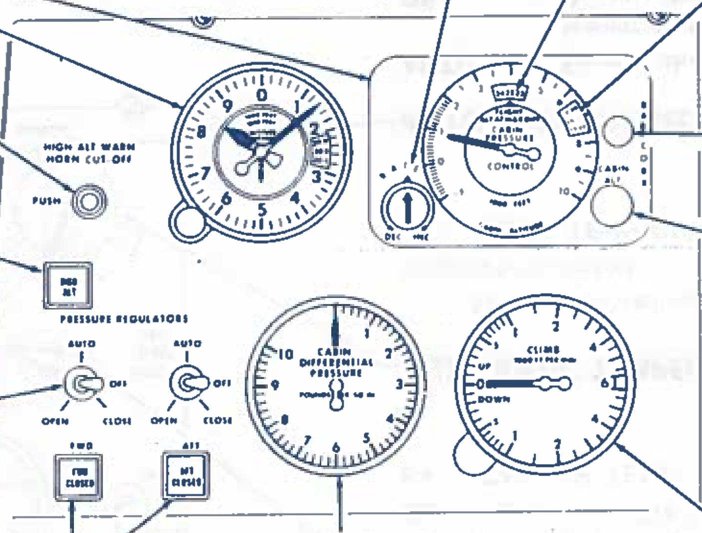
PRESSURE REGULATOR OVERRIDE SWITCHES

AUTO - Valves will be opened on landing and closed on takeoff by safety switches. Permits automatic controller to position valves to control pressurization.
OFF - Prevents electrical actuation of valves at any time.
OPEN - Overrides automatic control and drives valves open.
CLOSE - Overrides automatic control and drives valves closed.
C10 - CABIN PRESS REG FWD - AFT.

CABIN RATE OF CHANGE SELECTOR KNOB

Varies the rate at which the cabin changes from the existing to the selected altitude.

a. DEC - Approx. 50 FPM.
b. INDEX - Approx. 300 FPM.
c. INC - Approx. 2000 FPM.



CABIN DIFFERENTIAL GAUGE

Indicates in PSI the differential between ambient and cabin pressure.

VALVE CLOSED INDICATOR LIGHTS

Indicate anytime respective valve is closed.
C10 - CABIN PRESS REG FWD - AFT.

FLIGHT ALTITUDE WINDOW

Indicates what aircraft altitude will be when cabin is at selected altitude with cabin differential of 8.3 PSI.

BAROMETRIC CORRECTION WINDOW

Local altimeter setting (in. Hg) placed in window makes cabin altitude (long) pointer accurate.

BAROMETRIC CORRECTION KNOB

Rotates dial in correction window.

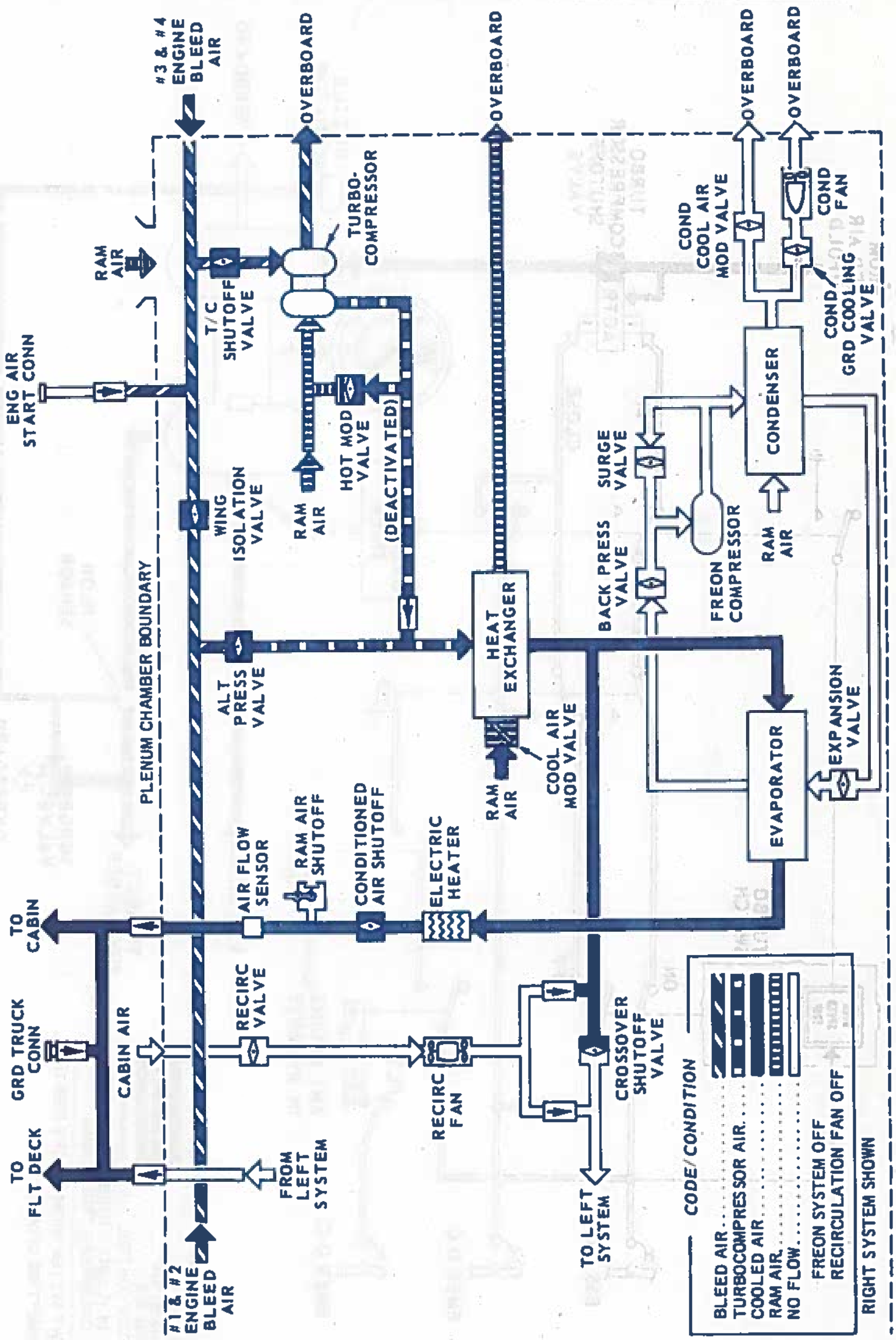
CABIN ALTITUDE KNOB

a. Rotates the long pointer and the dial in the FLIGHT ALT (upper) window.
b. The desired cabin altitude is selected by long pointer.
c. The long pointer shows what the cabin altitude will be when airplane is at the altitude selected in window and cabin differential is maximum (in auto).

CABIN RATE OF CHANGE INDICATOR

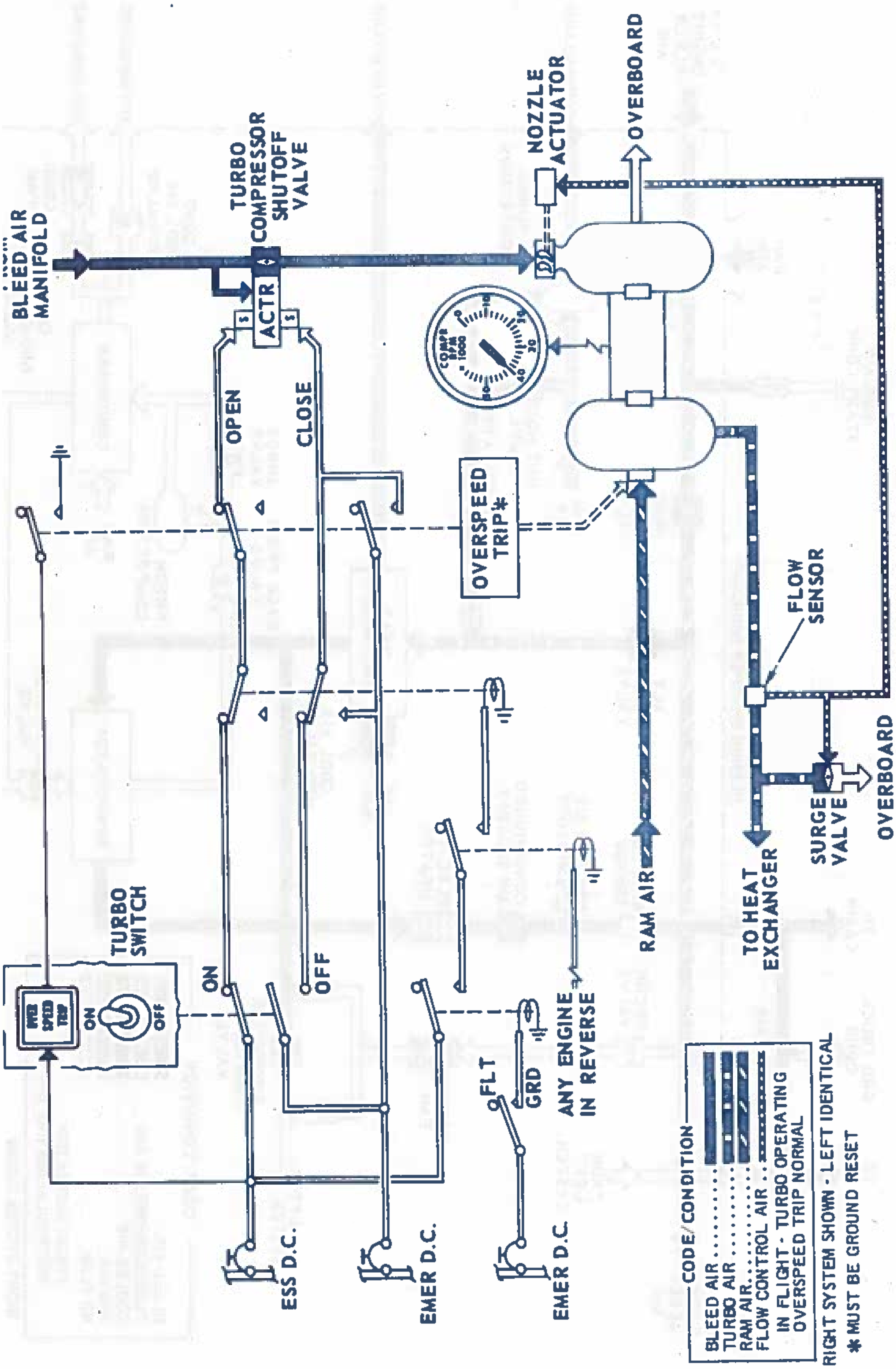
Indicates in thousands of feet per minute the rate at which cabin altitude is changing.

A. AIR CONDITIONING DUCTING

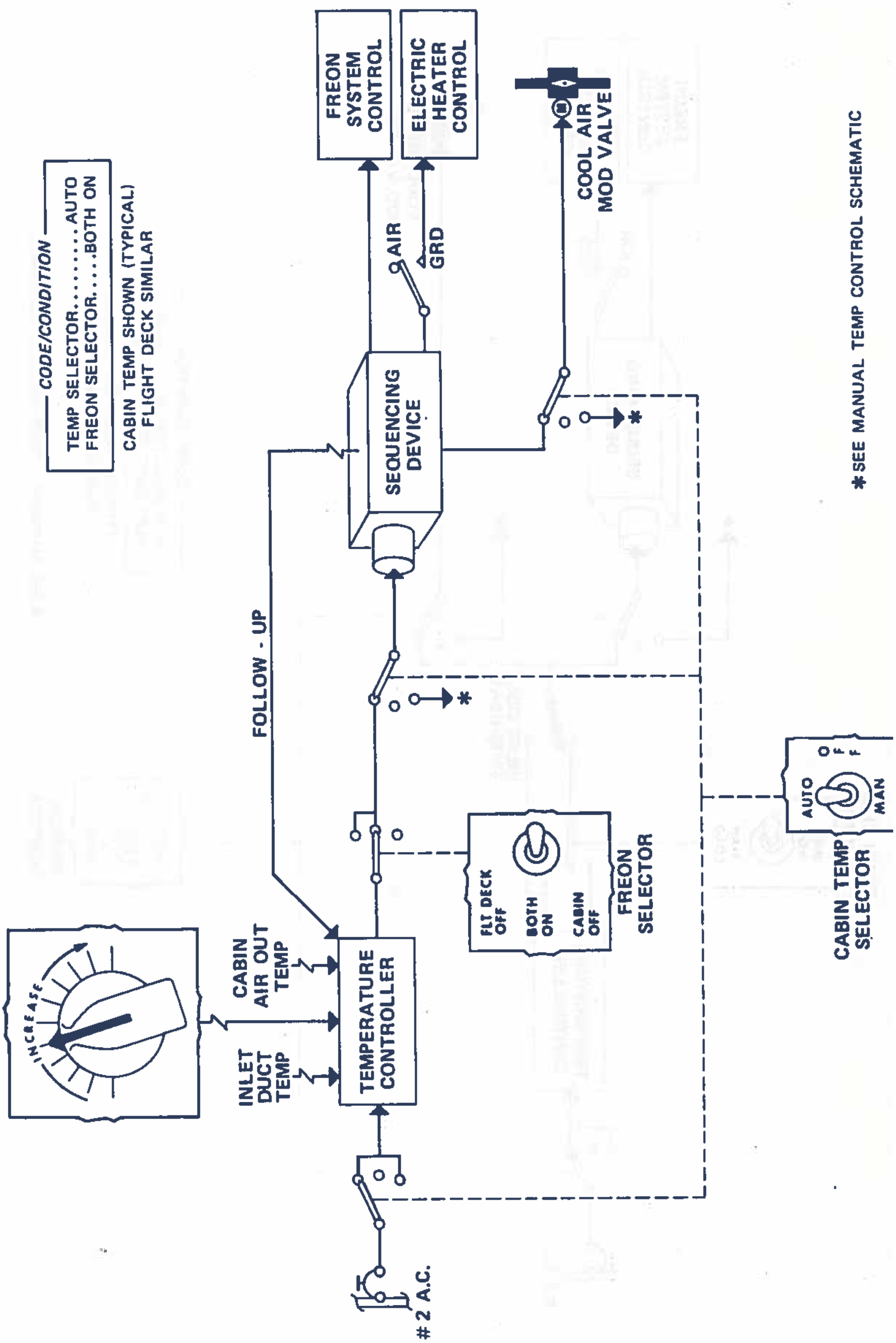


(4154)

TURBO COMPRESSOR CONTROL

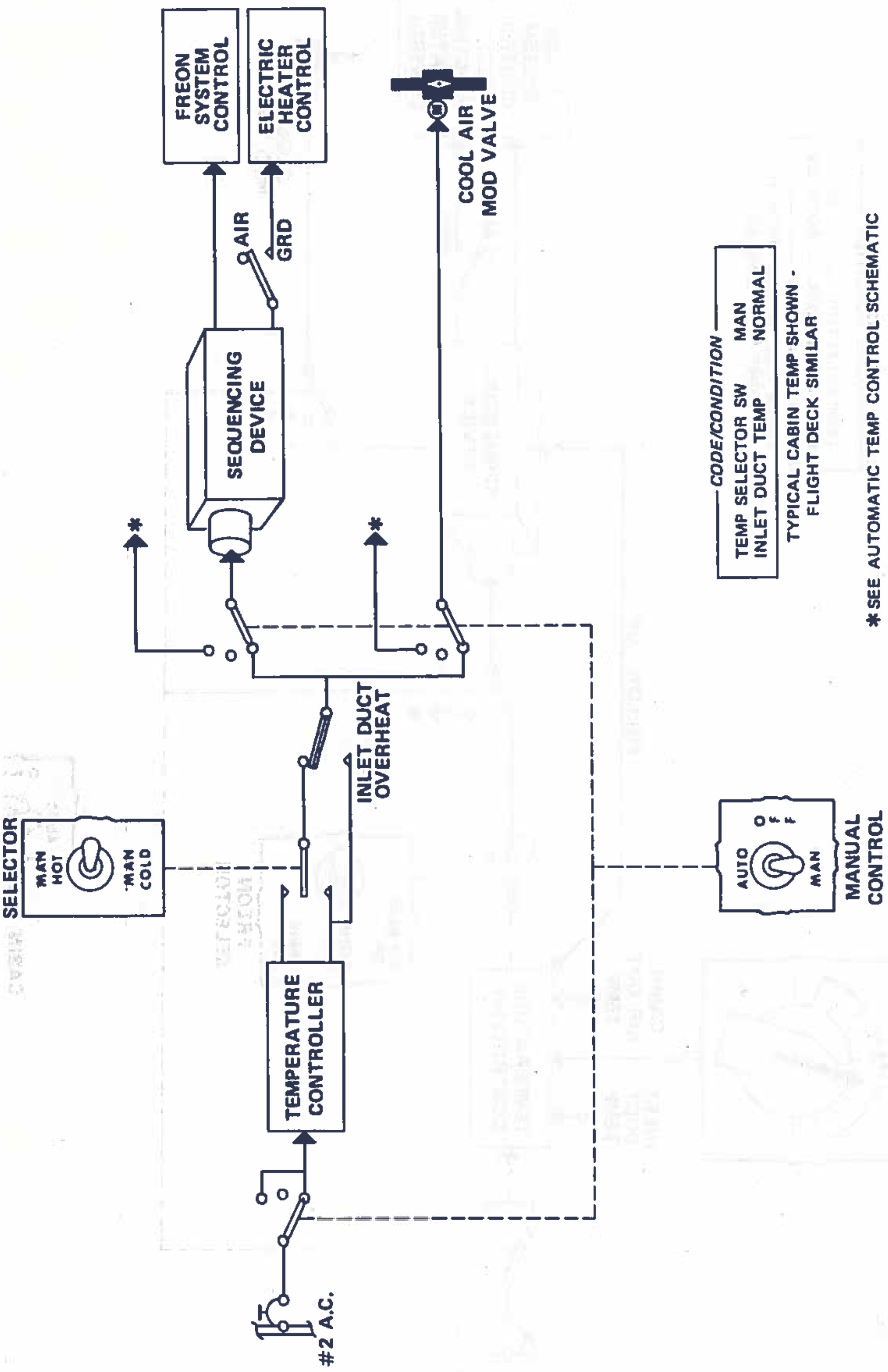


C. CABIN TEMPERATURE CONTROL - AUTOMATIC

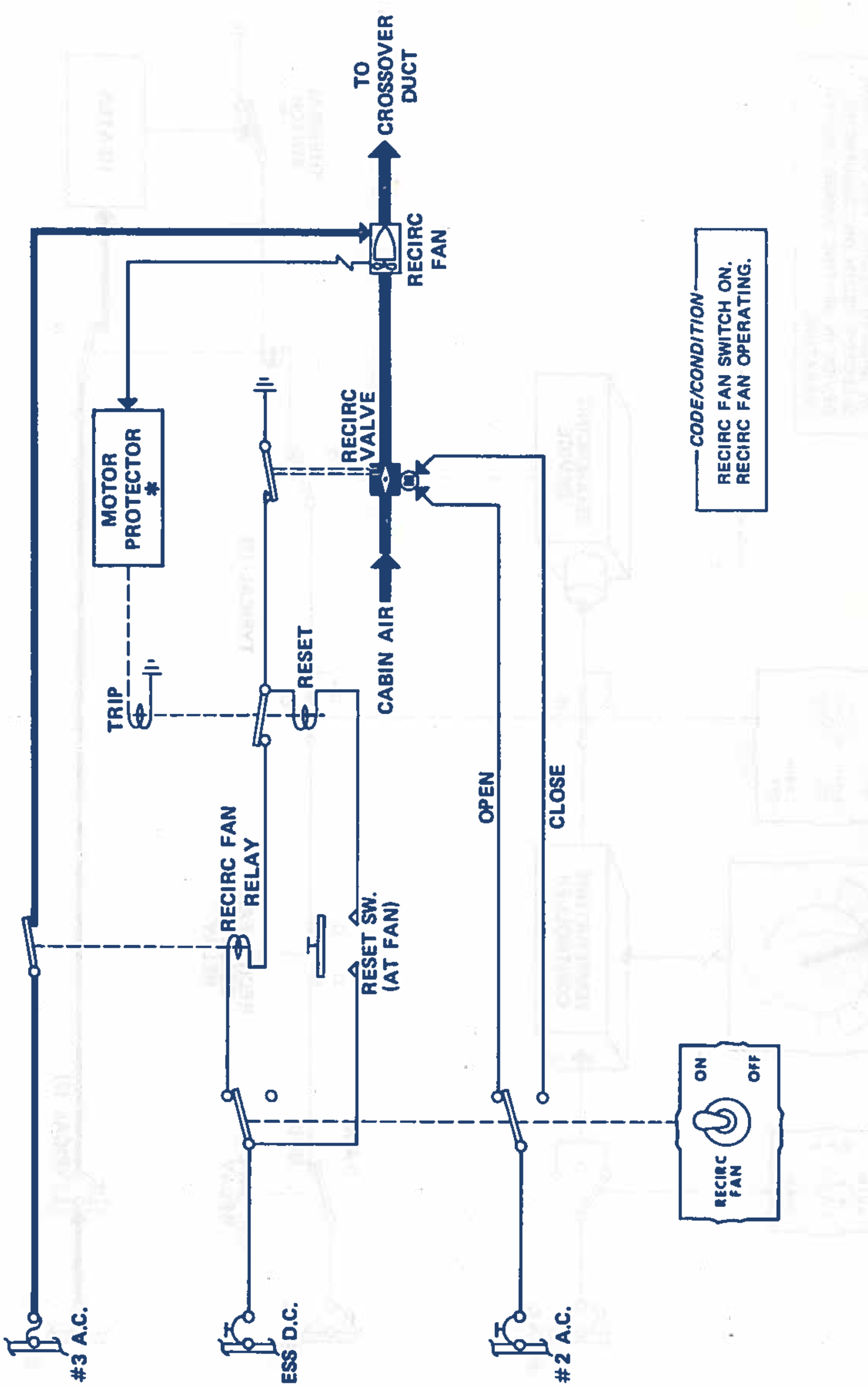


(4177)

CABIN TEMPERATURE CONTROL - MANUAL



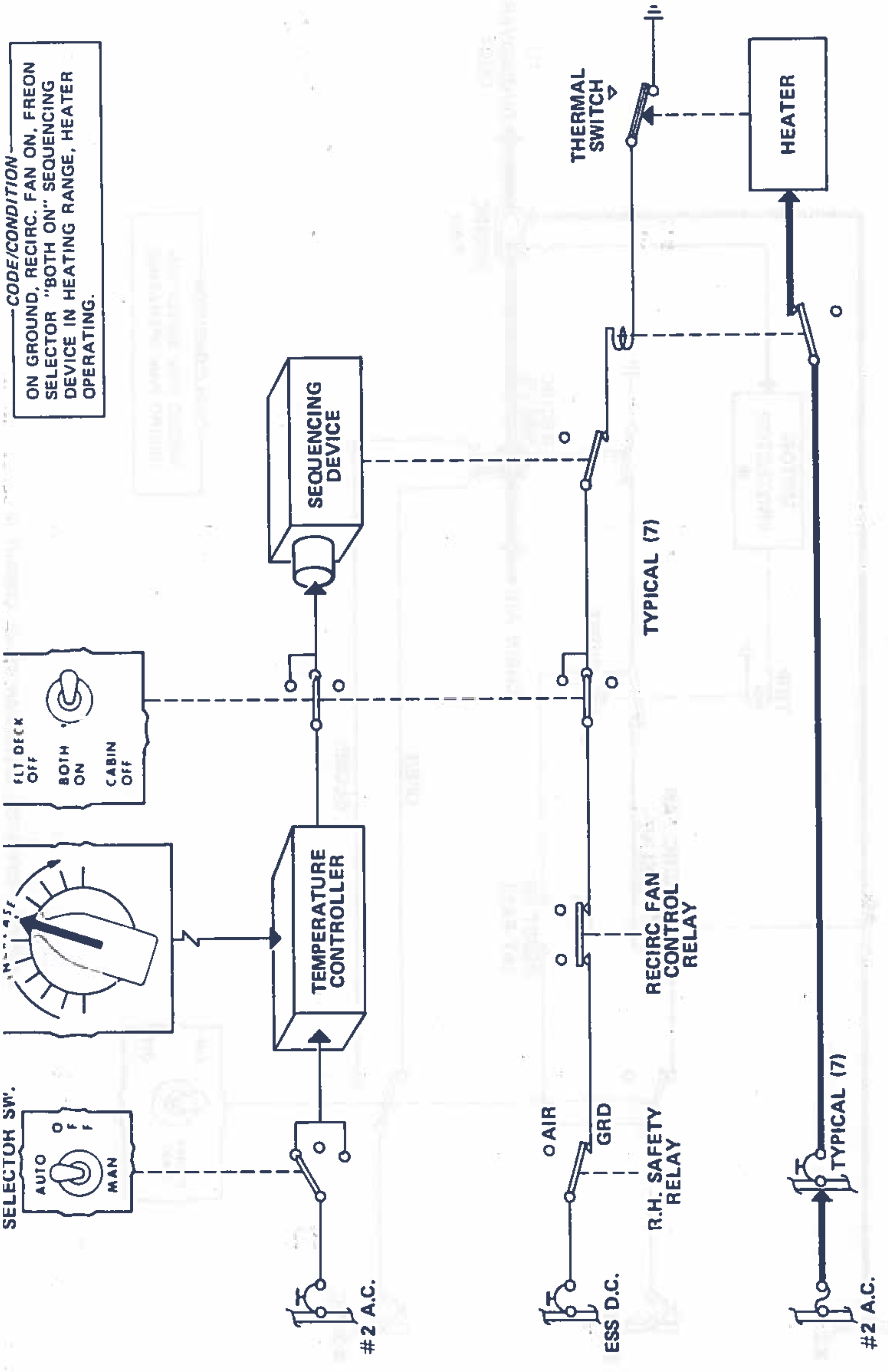
E. RECIRCULATION FAN AND VALVE OPERATION



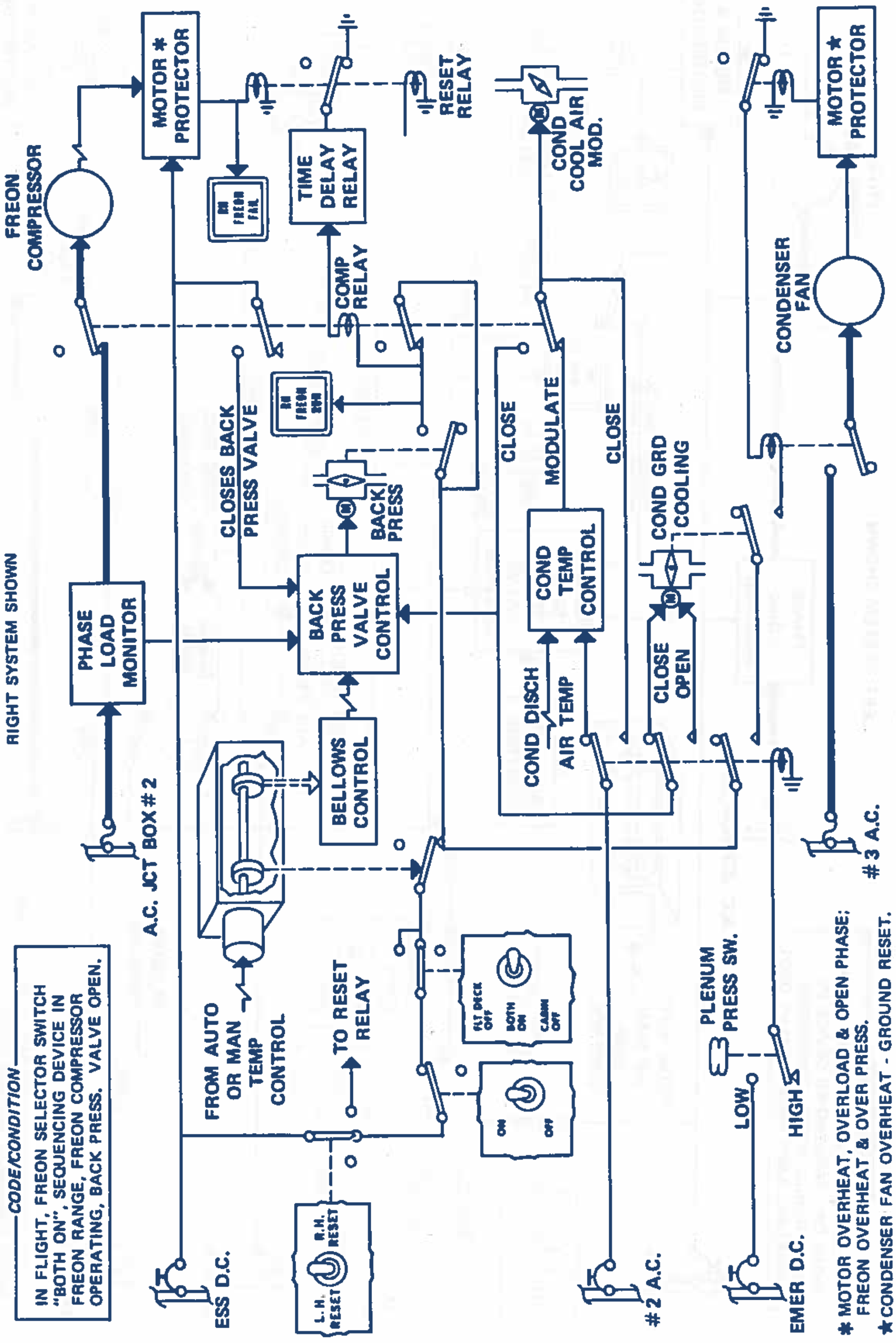
* MOTOR PROTECTOR OPENS FAN RELAY CIRCUIT IF MOTOR OVERHEATS OR PHASE OPENS. RESET CAN BE ACCOMPLISHED ON GROUND WITH RECIRC VALVE OPEN.

(4178)

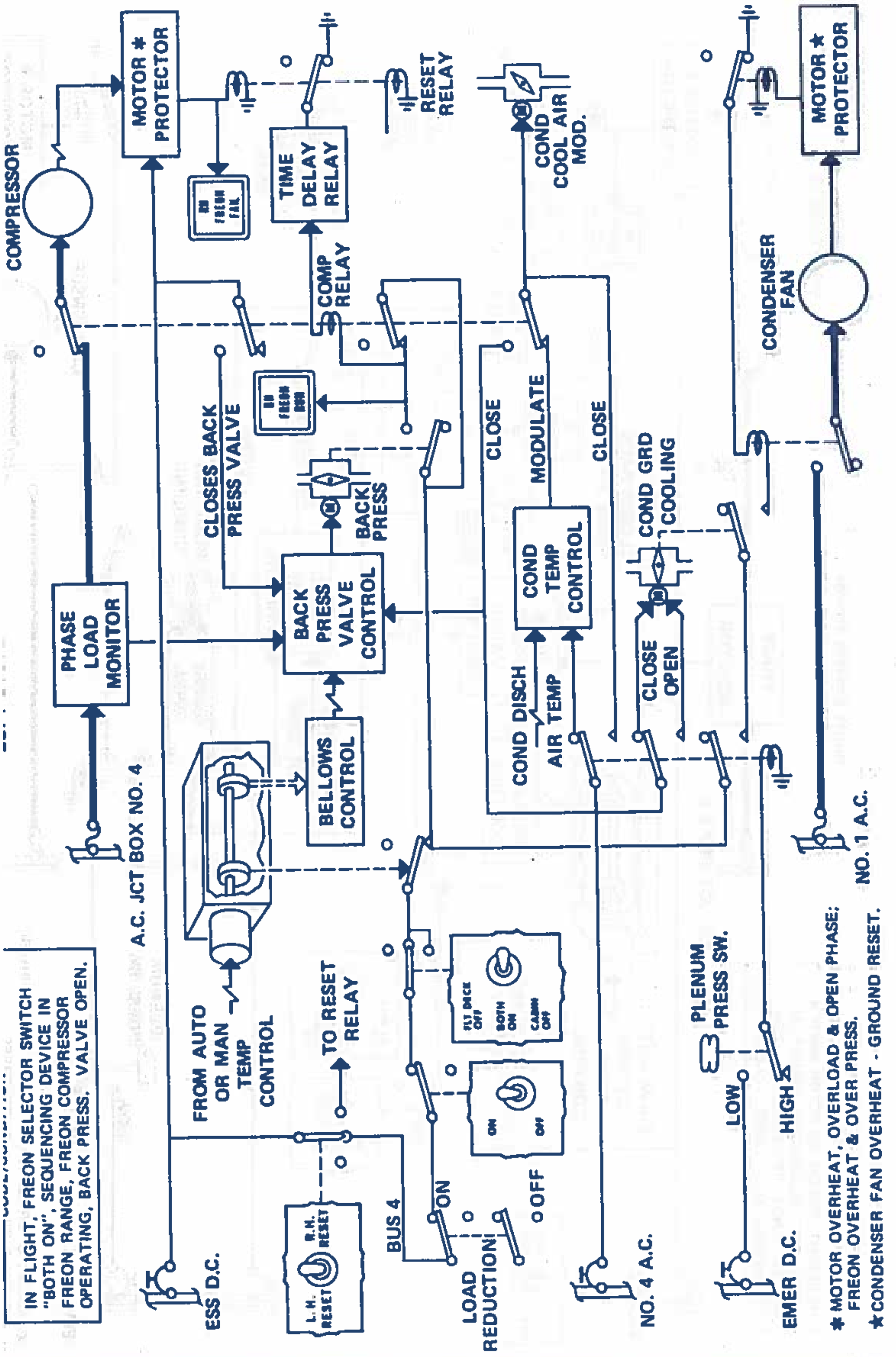
CABIN HEATER OPERATION



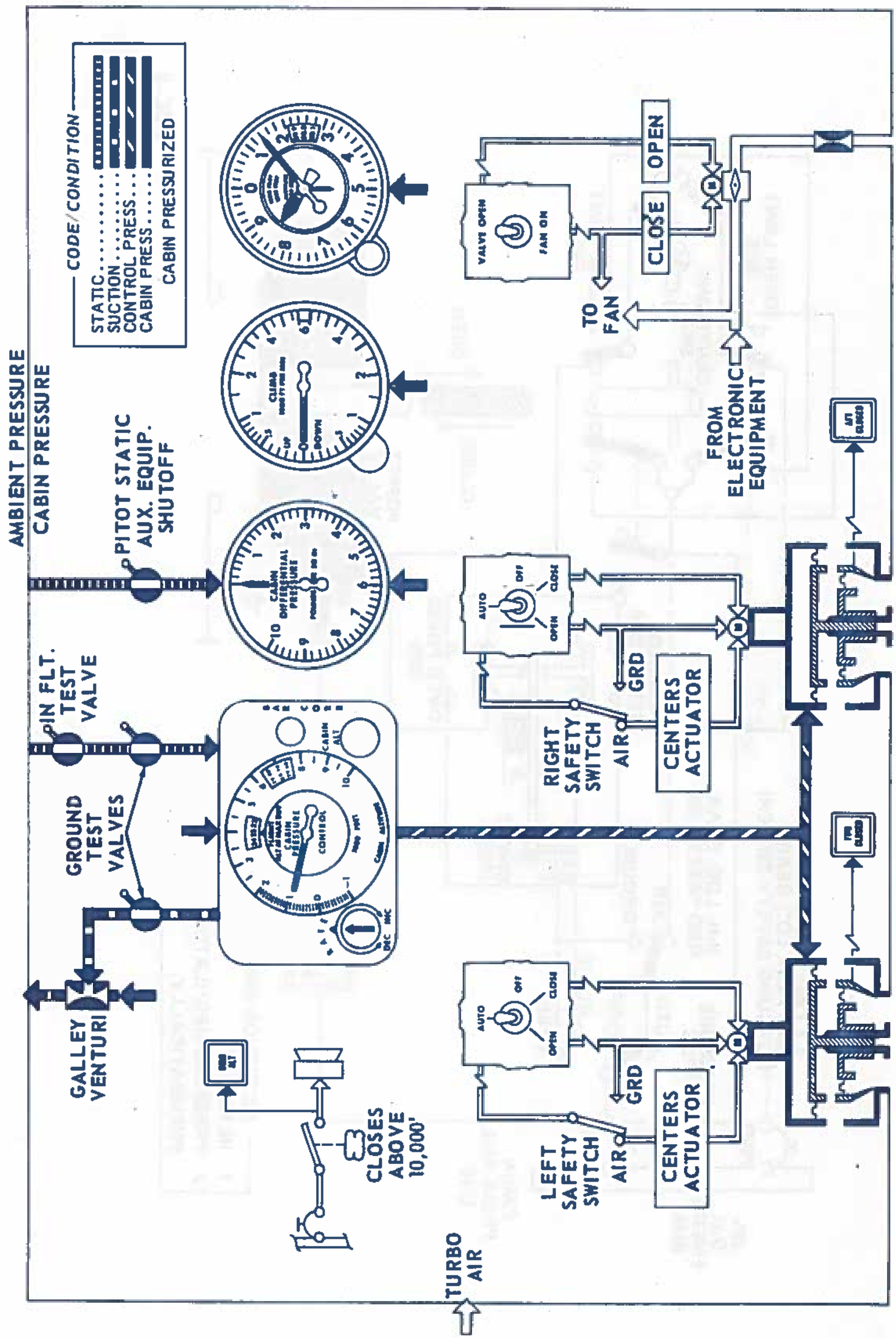
G. FREON SYSTEM CONTROL



FLIGHT DECK FREON SYSTEM CONTROL

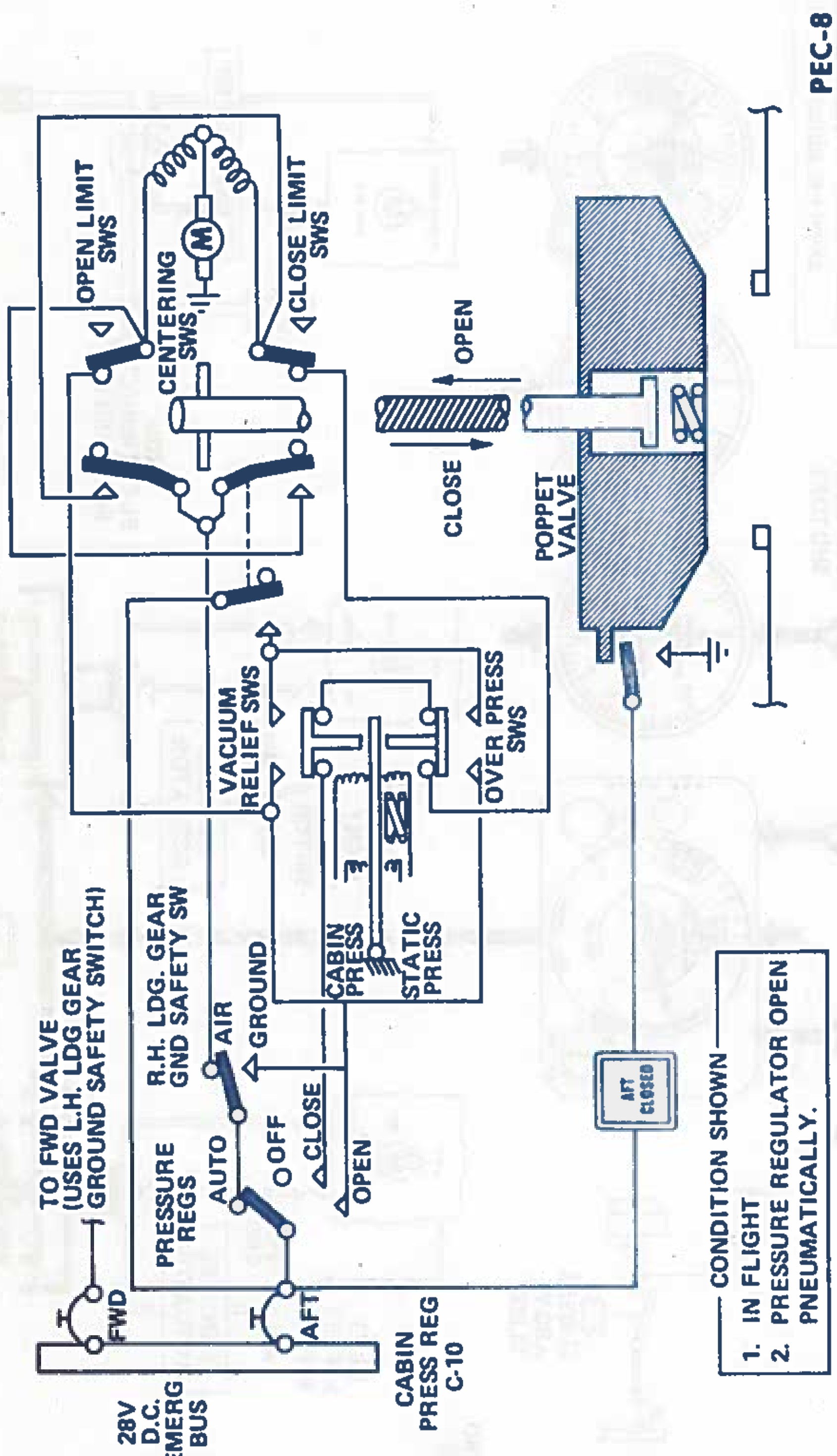


I. PRESSURIZATION CONTROL



(4269)

OUTFLOW VALVE ELECTRICAL CONTROL



A. AIR SOURCES AND DISTRIBUTION

Air conditioning controls are on the left side of the Engineer's upper panel and circuit breakers are on circuit breaker panel "C".

Normally the flight deck and the cabin turbocompressors, which are turbine-driven air compressors supply pressurizing air to the airplane through their respective air conditioning systems. Air to drive the turbines comes from the bleed air manifold which is supplied from the bleed valves of all four engines. However, should either turbocompressor malfunction this same bleed air can be ported through to supply the corresponding system, by placing that ALT PRESS SOURCE switch to OPEN.

Normally a maximum of two of the four pressure sources will be in use, and the recirculation fan will be off in flight. However, if an uncontrolled loss of cabin pressure is encountered, at high altitude, all four pressure sources will be used.

The air conditioning provisions consist of two separate but similar systems installed side by side in an unpressurized area of the fuselage beneath the wing. This compartment, known as the "plenum chamber", has ram air openings at the front to provide the turbocompressors and other components housed there with a needed supply of air. Both systems normally produce an equal quantity of pressurized and temperature conditioned air. The right-hand system normally supplies its total output to the cabin at the temperature set on the panel CABIN TEMP CONTROL selector. Approximately 15% of total air input goes to the cockpit and is normally supplied from the left system. The remainder of left system air joins the flow from the right system making approximately 85% of the total flow going to the cabin. If only one system is working, it will serve both compartments and its flow will be distributed in the above proportions. Temperature of cockpit air is determined by the FLIGHT DECK TEMP CONTROL selector setting. Also, flight deck system air going into the cabin system is this same temperature. So, the cabin system will adjust itself until the mixture becomes the temperature required for the cabin.

Conditioned air passes from distribution ducting directly into the compartments through side wall openings and from individual adjustable face vent outlets for each passenger and crew member. However, most flight deck air enters through a wall louver above the compartment door. Cargo compartments are sealed to meet fire suppression requirements, so their ventilation is held to a minimum. But, a pressure equilization port and a rapid decompression blowout panel are above each cargo compartment access door.

A ground air conditioning truck connection is provided, but the aircraft system is designed to be self sufficient if adequate electrical power is connected.

B. PRESSURIZATION CONTROL

The pressurization system can maintain a sea level cabin altitude up to an airplane altitude of 21,300 feet. At 41,000 feet airplane altitude, the cabin will reach 8,000 feet as the differential control within the CABIN PRESSURE CONTROL unit governs pressure to 8.3 $\pm$ .1 PSI cabin differential. Cabin pressure is regulated by one forward and one aft pressure regulator (outflow valve). Should either valve go closed, its amber CLOSED light will glow. Pressure regulator valve outflow poppets are positioned by pneumatic signals from the CABIN PRESSURE CONTROL unit on the air conditioning panel. A RATE knob on the control unit permits varying the rate at which the cabin altitude changes to a different selected altitude. Its range is from 50 to 2000 feet per minute. Should the differential control fail to limit cabin differential to the calibrated value during pneumatic operation, a pressure relief valve in each of the pressure regulators (outflow valves) will position the valve poppet to control differential at 8.5 $\pm$ .1 PSI. Also, the valves will relieve pneumatically at a negative differential of .36 PSI.

In the event cabin altitude should reach 10,000 feet, a red HIGH ALT light on the air conditioning panel will glow. Also, the landing gear warning horn will sound intermittently until silenced by a push-button. If cabin altitude increases to 13,000 $\pm$ 2000 feet, a cabin pressure limit control in each pressure regulator (outflow valve) will attempt to prevent a further increase by pneumatically positioning the pressure regulator valve poppet toward closed. A source of fresh air for "auxiliary ventilation" during unpressurized flight is obtainable by moving the RAM AIR SOURCE switch to OPEN.

Should pneumatic control of pressurization malfunction, each pressure regulator contains an electric motor for actuation. Two PRESSURE REGULATOR switches on the air conditioning control panel are normally in AUTO at which time the actuators are centered for pneumatic operation. Electrical acutation of either or both valves is accomplished by "toggling" the corresponding switch toward OPEN or CLOSE as desired. If during electrical operation cabin pressure differential reaches 8.1 $\pm$ .1 PSI, a switch in the pressure regulator will energize the valve toward open allowing pressure to escape. Similarly, if a negative differential of .36 is reached, the valve will be energized open to allow outside air to enter the cabin.

C. TEMPERATURE CONTROL IN FLIGHT

The temperature, desired in the cockpit and cabin should be set by positioning the FLIGHT DECK TEMP CONTROL selector and the CABIN TEMP. CONTROL selector respectively. Also, their AUTO-OFF-MAN "selector" switches must be in AUTO.

The temperature of air leaving the turbocompressors or alternate pressurization sources on its way into the aircraft is generally not the temperature required for passenger comfort. Therefore, various means of changing air temperature are provided.

The heat exchanger cool air modulation valve controls the ram air flow through the heat exchanger The heat exchanger normally provides sufficient cooling in cruise flight to keep the cabin and cockpit temperature at a satisfactory level. If additional cooling is required, the Freon refrigeration system will come on. The amount of refrigeration cooling produced is governed by the volume of Freon circulated through the system. This is controlled by varying the opening of the back-pressure valve.

TEMPERATURE CONTROL IN FLIGHT

In order to control cabin temperature in flight, it is necessary to correctly position the cool air mod valve and the freon back pressure valve at all times. Determination of which particular valve to move and the amount of movement required is a function of the automatic temperature control for each system. The cabin and the flight deck each have a sensor which "feels" the temperature of air leaving the compartment. A temperature control unit (black box) compares this temperature with what the TEMP CONTROL selector is set for. If they are not the same, this means a temperature change is needed. Power is then sent to the sequencing deivce which "delivers" the correct (open or close) "change signal", in the form of actuating power, to the valve which needs to move to produce the temperature change. When a valve moves it sends "feed-back" signals to the temperature control. This, along with the effect of temperature change on the compartment sensor, finally removes (nulls out) the original change signal and thus the temperature control becomes "satisfied" (no further temperature change or valve movement are needed at this time). In this manner, the selected temperature is automatically obtained and controlled.

In the event of malfunctioning in AUTO position of the TEMP CONTROL "selector" switch, it can be moved to MAN position and the MAN HOT - MAN COLD switch "toggled" as necessary to obtain desired temperature. In manual control the operator provides the temperature intelligence by switch position. This in turn drives the sequencing device which delivers hot - cold signals to move the Freon back pressure valve much the same as in AUTO. However, the cool air mod valve is driven direct to assure some temperature control in case automatic malfunctioning was caused by sequencing device failure.

Should a system become incapable of maintaining the selected temperature due to a FREON FAIL light on, or some component malfunction, the FREON PACK "selector" switch can be moved from BOTH ON to FLIGHT DECK OFF or CABIN OFF as applicable. This will position valves to port all air through the system whose components remain operative. That system TEMP. CONTROL setting will now govern air temperature to both compartments and the automatic function of the other temperature control is now deactivated.

TEMPERATURE CONTROL ON GROUND

With turbocompressors off on the ground, air movement is by means of one recirculating fan which serves the flight deck and the cabin. Separate automatic temperature control for each compartment is achieved by modulating the respective Freon back pressure valve for refrigeration or by energizing one or more of the seven electric heaters in that system. Recirculated air is picked up from the belly through a recirculation valve aft of the front cargo compartment. After passing through the "conditioning" system, the air enters the cabin and flight deck through the normal distribution system. Cabin air finally passes beneath the floor through wall louvers under passenger chairs and is again picked up by the recirculating fan.

* * *

*   *   *

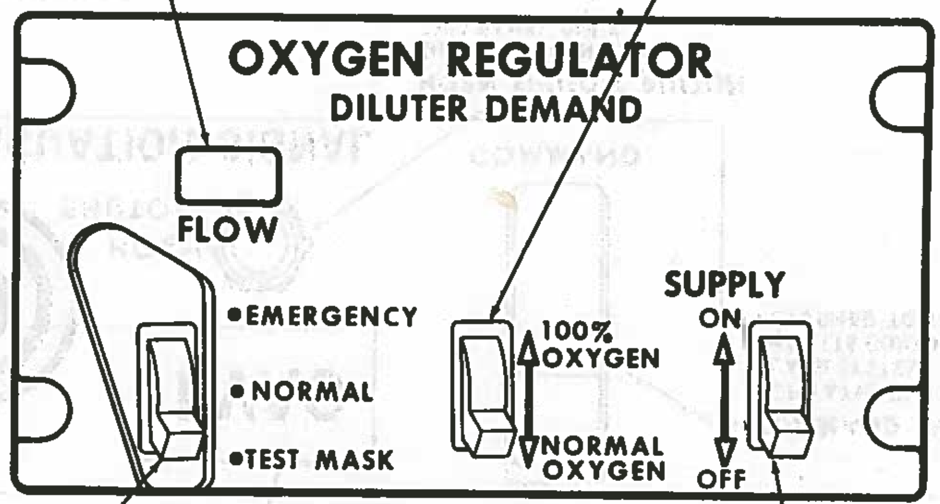
FLIGHT CREW OXYGEN SYSTEM REGULATOR

FLOW INDICATOR

Indicates white when oxygen is flowing from regulator.

OXYGEN SELECTION LEVER

100% - Pure oxygen on demand.
NORMAL - Air/Oxygen mixture on demand.
Ratio determined by cockpit altitude.



OXYGEN REGULATOR PANEL
(TYPICAL 4 PLACES)

EMERGENCY LEVER

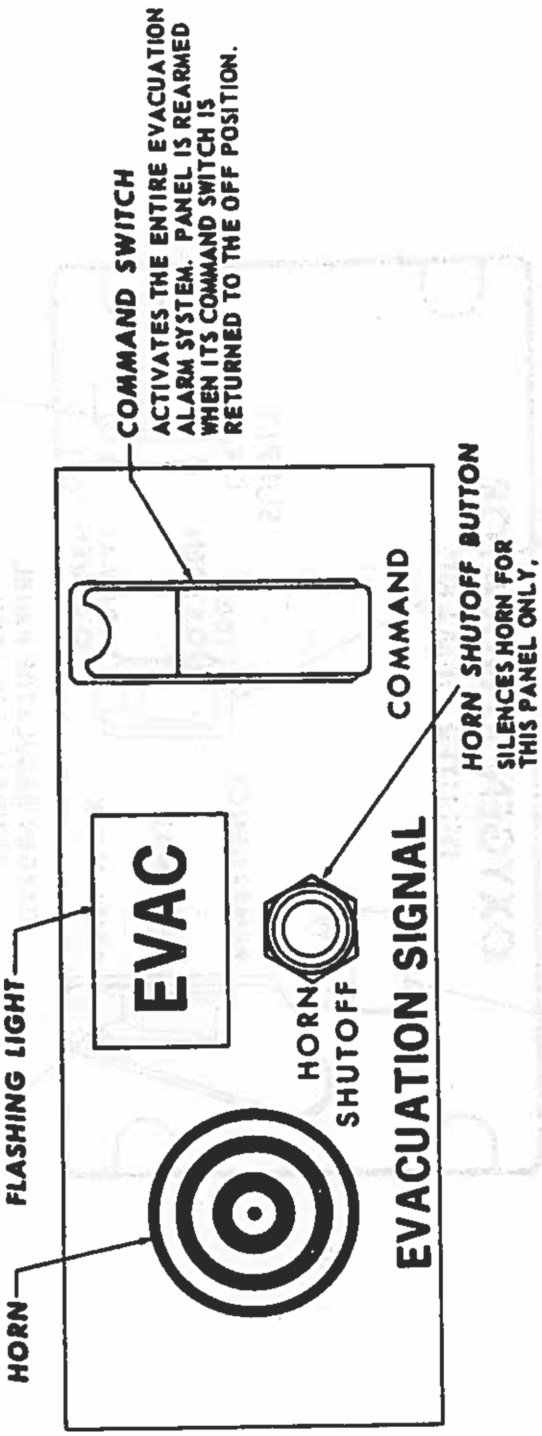
EMERG - Converts regulator to continous flow.
NORMAL - Allows regulator to deliver oxygen on demand.
TEST - Momentary lever not used.

SUPPLY LEVER

Provides means of shutting off oxygen supply at the regulator.

(4764)

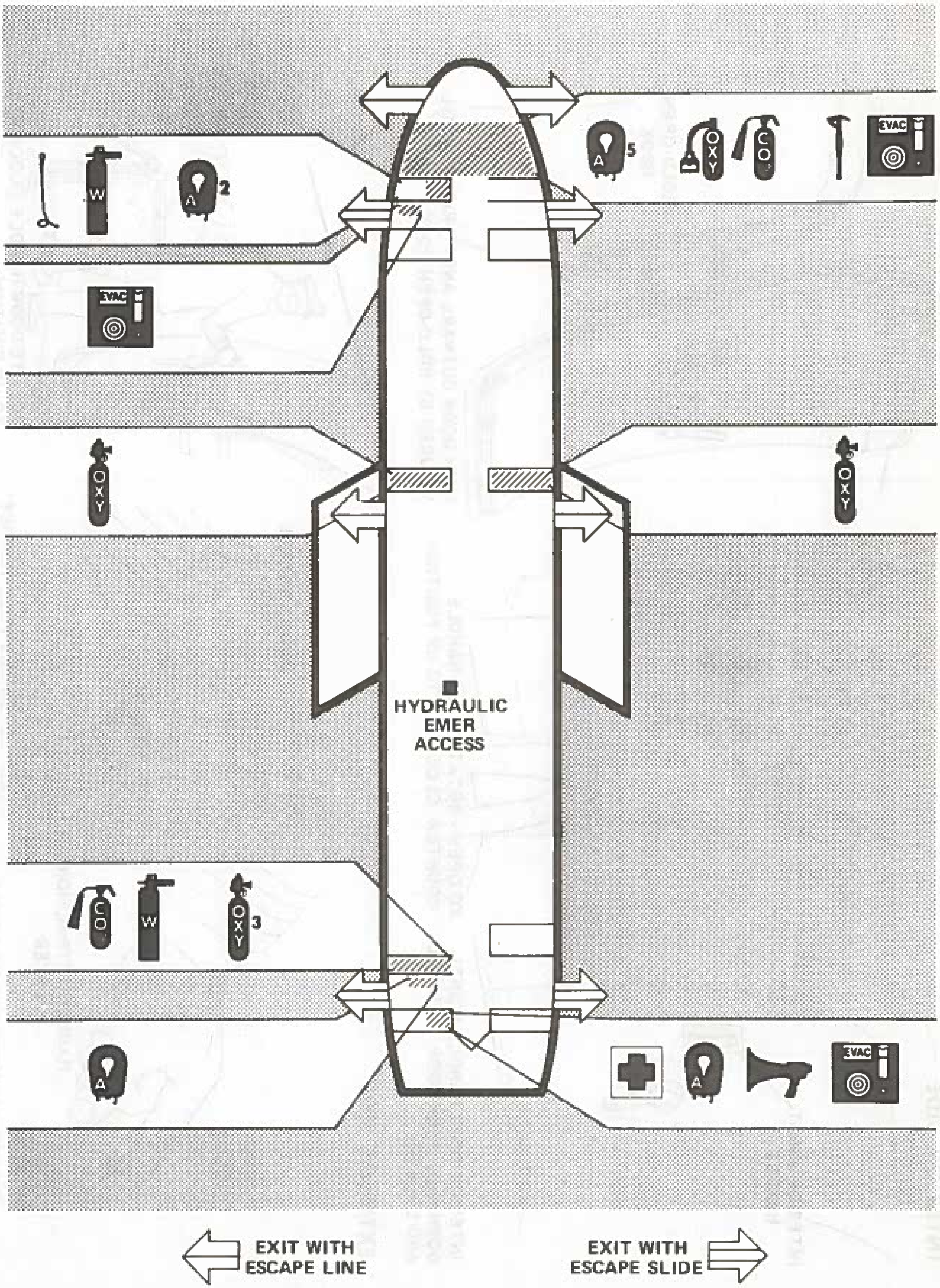
ACUATION SIGNAL ALARM PANEL



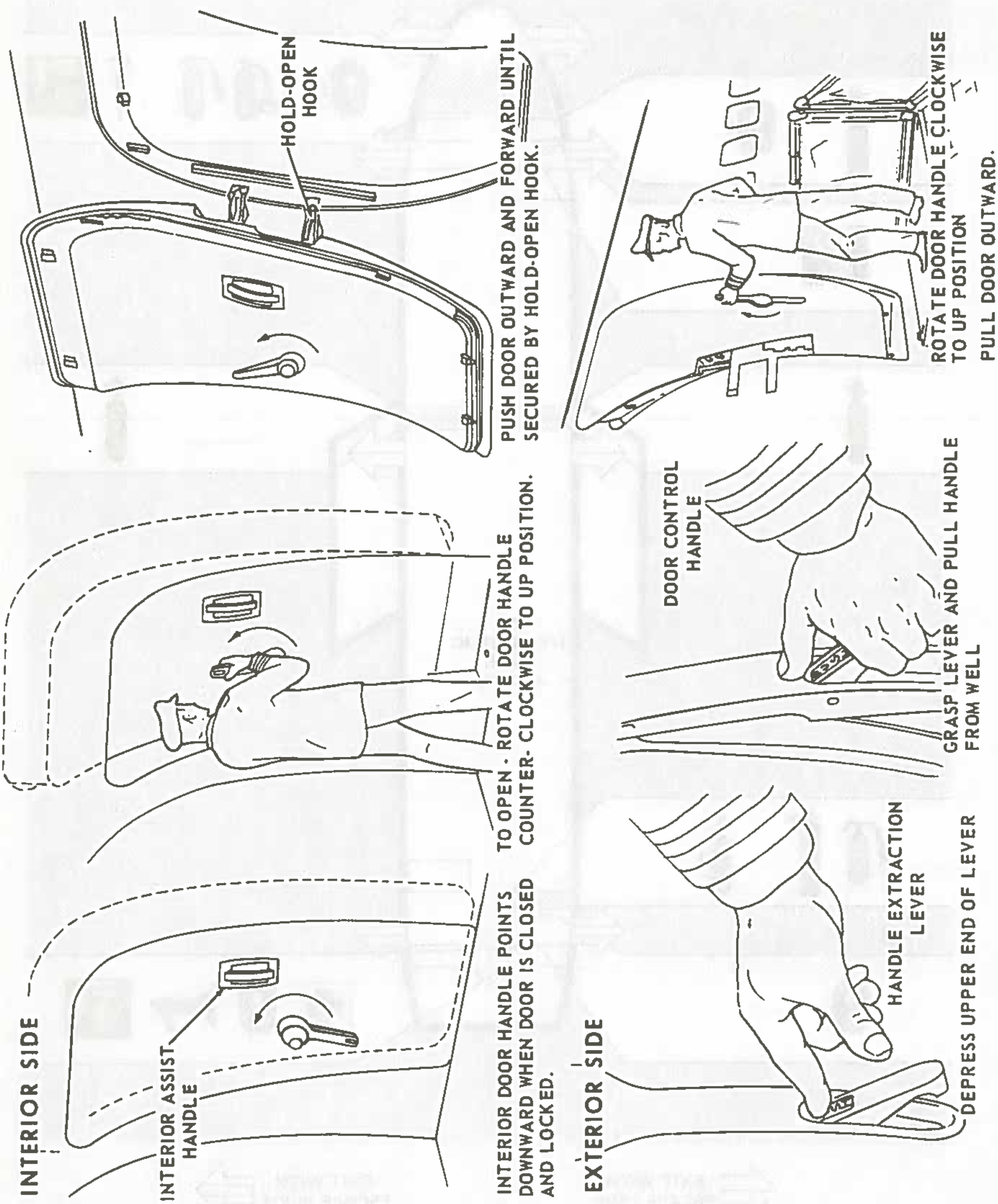
A8 - EVAC SIGNAL

* * *

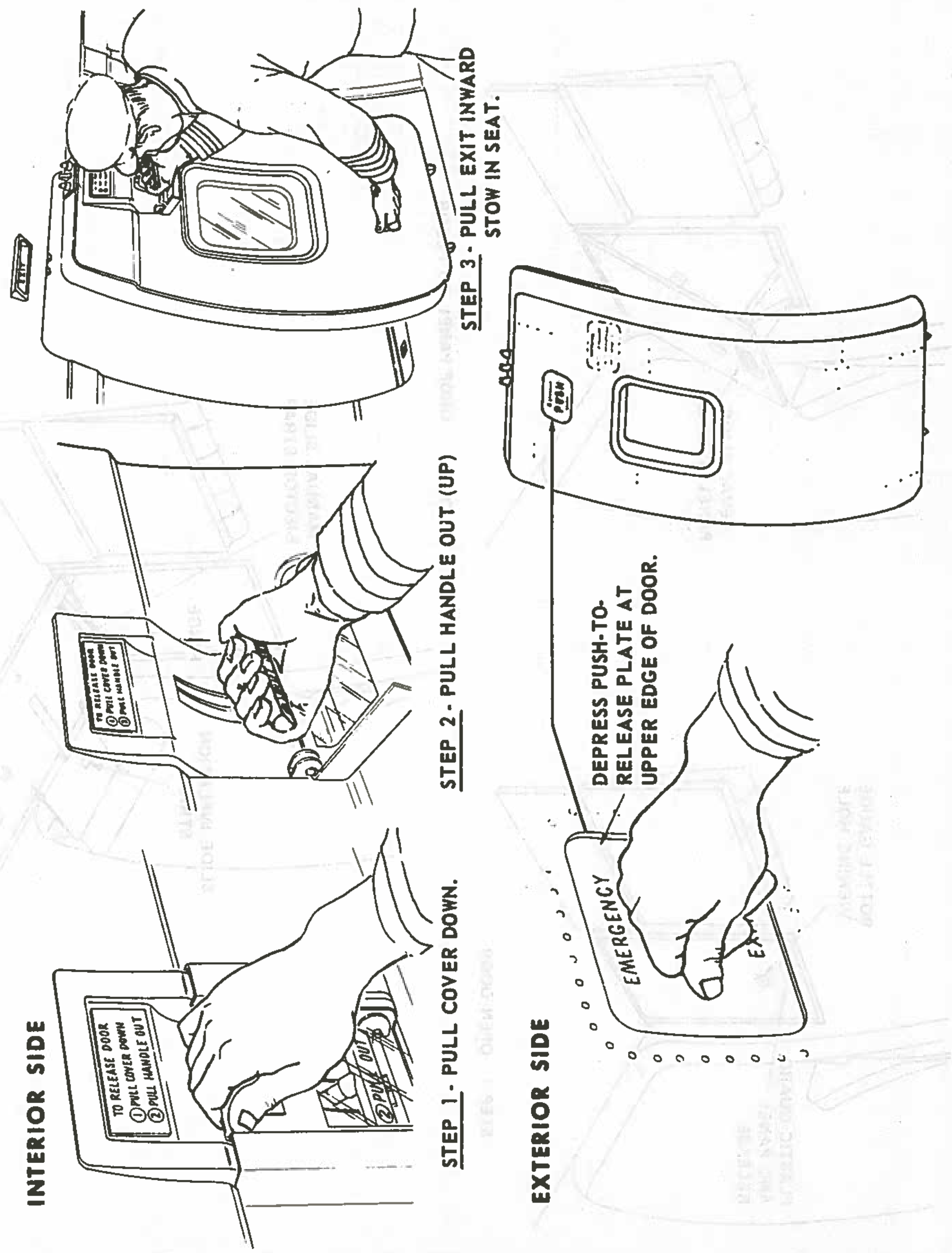
EMERGENCY EQUIPMENT LOCATIONS



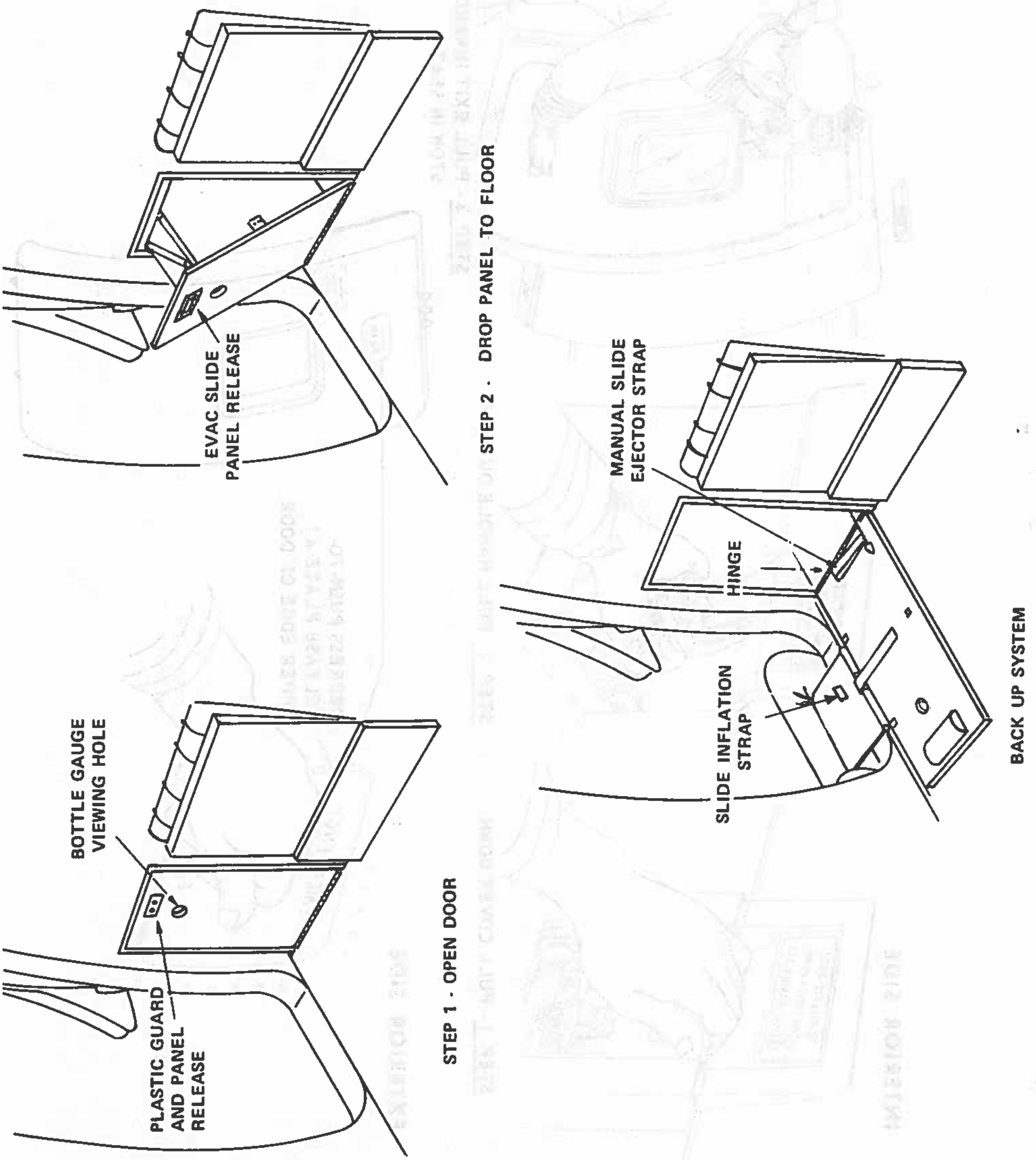
OR OPERATION



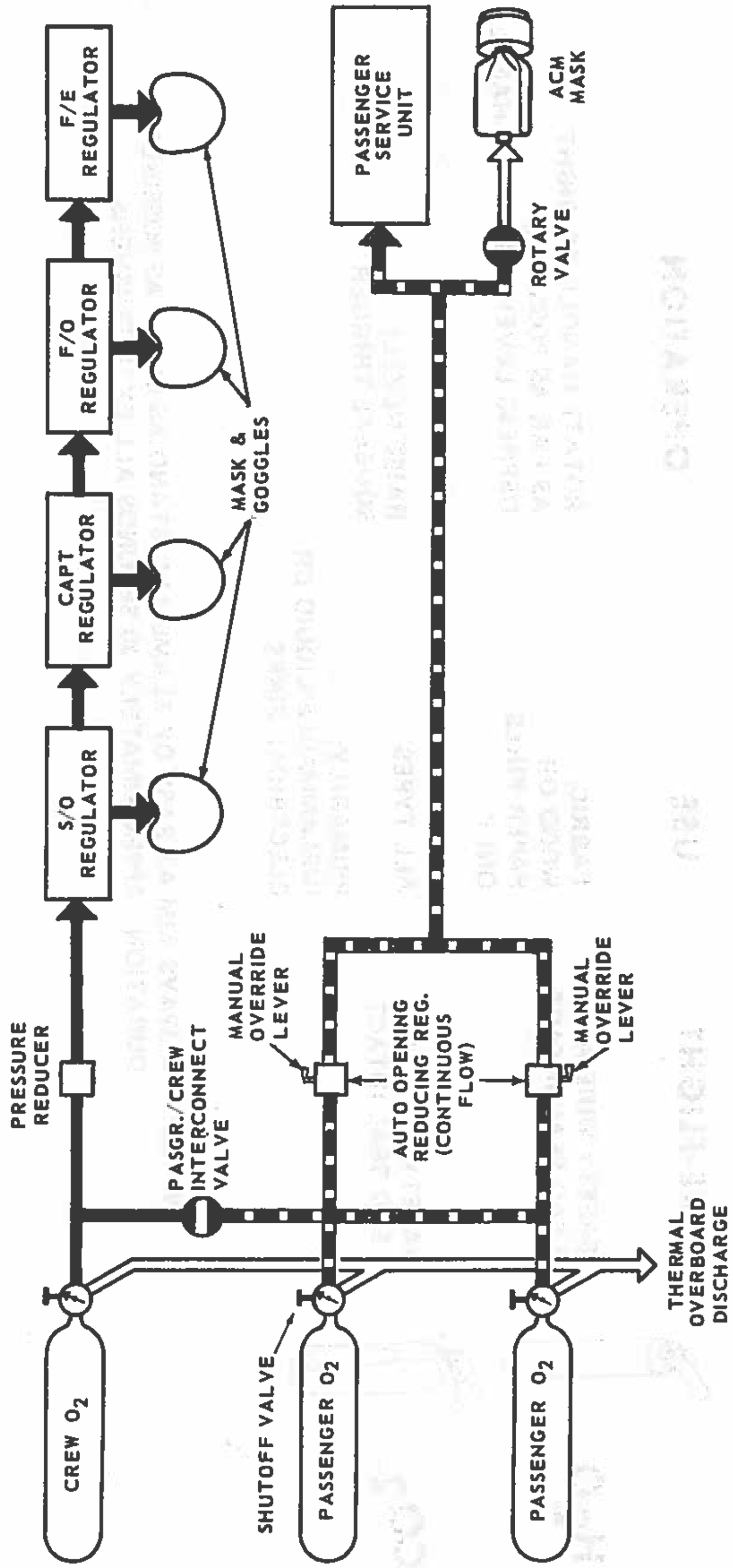
EMERGENCY EXIT REMOVAL



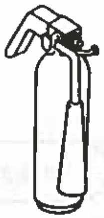
EVACUATION SLIDE OPERATION



OXYGEN SYSTEM SCHEMATIC



(4271)

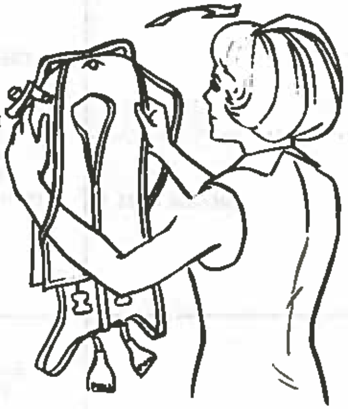
		PRE-FLIGHT	USE	OPERATION
H_2O		SAFETY WIRE AND LEAD SEAL INTACT	FABRIC, WOOD OR PAPER FIRES ONLY.	ROTATE HANDLE TO RIGHT AS FAR AS POSSIBLE, DEPRESS LEVER ON TOP OF HANDLE
CO_2		SAFETY WIRE AND LEAD SEAL INTACT	ALL TYPES PRIMARILY; INFLAMMABLE LIQUID OR ELECTRICAL FIRES	RAISE NOZZLE SQUEEZE TRIGGER

NOTES: ALWAYS AIM AT BASE OF FLAME AND STAND AS CLOSE AS POSSIBLE.
DURATION - APPROXIMATELY 30 SECONDS ALL EXTINGUISHERS.

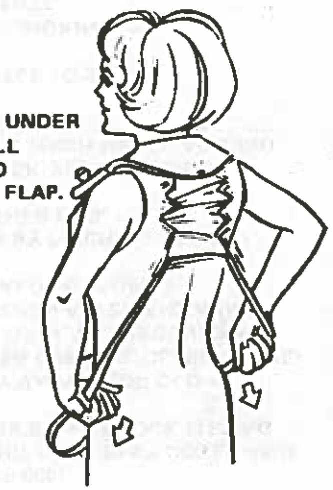
LIFE VEST

1. REMOVE VEST FROM PLASTIC PACKAGE.

2. PLACE ARMS THROUGH STRAPS AND PULL VEST OVER HEAD. VEST IS REVERSIBLE, MAY BE DONNED FROM EITHER SIDE.

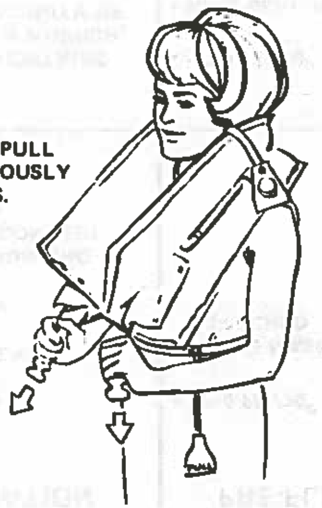


3. GRASP STRAPS UNDER ARMS AND PULL DOWNWARD TO EXTEND BACK FLAP.

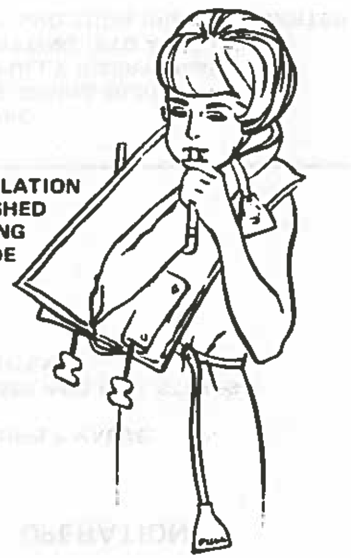


4. TIGHTEN STRAPS SECURELY ABOUT THE WAIST BY PULLING OUTWARD.

5. TO INFLATE, PULL DOWN VIGOROUSLY ON RED TABS.



6. IF NECESSARY, INFLATION CAN BE ACCOMPLISHED ORALLY BY BLOWING INTO TUBES AT SIDE OF VEST.



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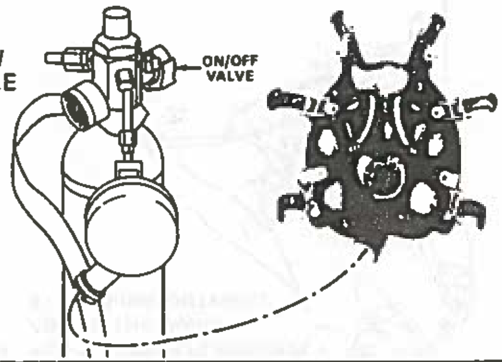
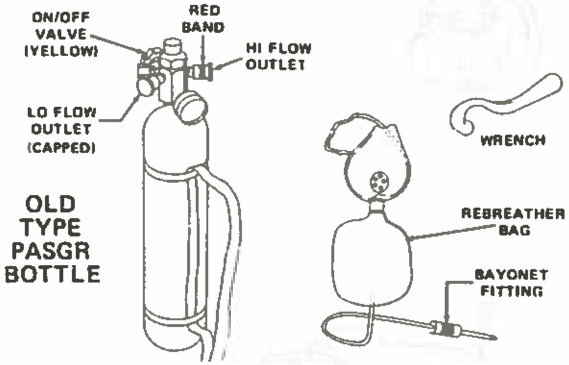
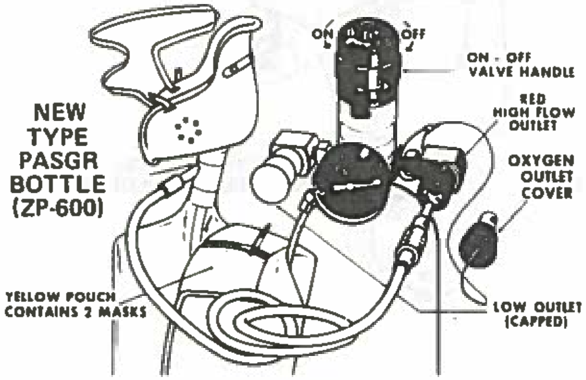
ɔRTABLE OXYGEN BOTTLES

	INFORMATION	PRE-FLIGHT	OPERATION
CREW BOTTLE 	• 100% DEMAND • CREW USE ONLY • 14 MIN SUPPLY • CREW QUICK DONNING MASK CAN BE CONNECTED TO BOTTLE.	• 1750 PSI/70° • SMOKE MASK ATTACHED.	1. OPEN SUPPLY VALVE. 2. DON MASK AND PULL STRAPS TO TIGHTEN.
OLD TYPE PASGR BOTTLE 	• MASK POUCH CONTAINS 2 MASKS AND A WRENCH. LOCATED IN VICINITY OF BOTTLE. • HIGH FLOW (RED) OUTLET FOR FIRST AID OXYGEN. • LOW FLOW OUTLET INCREASES OXYGEN ENDURANCE, ALLOWS TWO PERSONS ON SAME BOTTLE, ETC.	• 1750 PSI/70° • WIRE SEAL INTACT ON MASK POUCH	1. OLD TYPE: ROTATE SPRING DUST COVER AND FORCEFULLY INSERT MASK'S BAYONET FITTING INTO APPROPRIATE OUTLET AND TURN RIGHT A QUARTER TURN 1A. NEW TYPE (ZP-600): REMOVE TWIST LOCK DUST COVER AND ATTACH MASK'S TWIST LOCK FITTING. 2. OPEN SUPPLY VALVE. (ON OLD MODEL, AFTER OPENING, CLOSE VALVE A QUARTER TURN. IF NEEDED, USE WRENCH TO OPEN AFTER ENSURING VALVE NOT ALREADY OPEN). 3. CHECK FLOW BY PINCHING OFF TOP OF REBREATHER BAG. 4. STRAP ON MASK, PULL STRAPS TO TIGHTEN, AND PINCH METAL AROUND BRIDGE OF NOSE. 5. SECURE BOTTLE TO SEAT. 6. MONITOR NO SMOKING IN ADJACENT SEATS. 7. BEGIN CHANGING BOTTLE AT 500 PSI.
NEW TYPE PASGR BOTTLE (ZP-600) 	• MASK POUCH ATTACHED TO BOTTLE CONTAINS 2 MASKS (NOT INTERCHANGEABLE WITH ABOVE BOTTLE). • FLOW OUTLETS AS ABOVE.	• 1750 PSI/70°	

A. **SHOULDER HARNESS**

The shoulder harness is designed to give freedom of movement during normal operating conditions while automatically locking the harness during an abrupt deceleration. The inertia reel is adjusted to lock at 2 to 3 G's abrupt deceleration.

Inertia type reels are installed on the captain, first officer and engineer seats. The release button is located on the inboard side of the captain and first officer's seat and on the left side of the engineer's seat.

To check the inertia reel, grasp the shoulder harness straps and jerk them forward. This will lock the reel and prevent further forward movement but the reel will continue to take up any slack in the straps.

To release the lock, relax pressure on the straps and press the release button. The lock will not release unless the straps are relaxed. Regardless of the harness condition (locked or free) releasing the harness from the seat buckle will allow the shoulder harness to retract into the seat back. The harness may be released separately by pressing forward on metal tabs located at the top of the buckle.

B. **EVACUATION SLIDES**

To operate:

1. Open cabin door and push out to the locked position.
2. Drop panel to floor. Slide will eject over door sill and inflate automatically.

NOTE
There are two manual backup systems installed on the slide unit in case of malfunction:

a. If the slide fails to eject over the door sill after dropping panel to floor, pull the manual slide ejector strap. The strap is located next to the hinge of the slide panel.

b. If the slide ejects over the door sill but fails to inflate, pull the slide inflation strap, located on slide girt.

If slide was inadvertently dropped before opening the door, open door and push slide container out.

If the slide will not inflate, or deflates, it may still be used by positioning able-bodied persons at the bottom to hold slide extended using hand holds provided on the slide.

C. **ESCAPE ROPES**

Escape ropes are attached and stowed at both emergency wing exits. To use, remove the window exit and pull the rope out to its fullest extent. Throw the rope over the leading edge of the wing.

Some aircraft have a longer rope. The extra length extends down the window frame and into a storage box below the window. The rope is exposed only after the window exit has been removed. The longer rope can be extended over either the trailing edge or leading edge of the wing.

One rope is located at each cockpit sliding window. These ropes are secured aft of each pilot console. A red hook is provided above the sliding panel through which the rope must be placed when deployed.

One additional loose rope is stowed in the forward coat closet.

D. **EMERGENCY EXIT LIGHTS**

The Emergency Exit light system includes both the Interior Emergency Exit lights and the Exterior Emergency lights. The system will provide emergency lighting automatically whenever essential DC electrical power has been lost on the aircraft.

Operating power for the lights is normally supplied by the Emergency DC bus. If Emergency DC power is not available the lights will be powered by self-contained battery packs located in the right hand hat rack.

Two switches are installed for controlling the Emergency lights, one in the cabin at the forward hostess jump seat and one located on the pilots overhead panel. The Emergency light switch located at the forward hostess jump seat will turn on all Emergency lights, including the cockpit emergency light, regardless of the position of the pilots overhead switch or the position of the aircraft battery switch. The Emergency light switch on the pilots overhead panel controls the operating modes of the system.

1. COCKPIT SWITCH POSITIONS

a. ON
When turned ON all Emergency lights will come on and receive power from the Emergency DC bus or from the battery packs.

b. OFF
When turned OFF the switch is positioned so that all Emergency lights will come on automatically with a loss of essential DC power. The lights will be powered by the Emergency DC bus or the battery packs.

c. SHUTDOWN
This position will prevent activation of the Emergency lights when all electrical power is removed from the aircraft. Control power for the lights is supplied by the Emergency DC bus. For this reason Emergency DC power must be available prior to placing the cockpit control switch to the SHUTDOWN position.

E. **PORTABLE MEGAPHONE**

A self-contained, battery powered megaphone is installed on the shelf above the aft coat compartment.

To operate, squeeze the trigger located on the handle and speak normally into the mouthpiece. A volume control knob, on the back of the unit, may require adjustment to provide the desired voice amplification.

To prevent damage of the volume control stops, do not force the knob against the end of its travel in either direction. With the volume control knob set at 1:00 o'clock position, output should be sufficient to be heard throughout the airplane.

FIRST AID KIT

One first aid kit is stowed in a small compartment above the aft cabin attendant's aisle seat.

CRASH AXE

A crash axe is stowed on the forward side of the cockpit to cabin door.

SEAT CUSHIONS

The passengers seat cushions are approved flotation equipment. Pull cushion to remove from seat. Instruct passengers to hold cushion against chest and place hands around cushion and through straps and rest chin on top of cushion.

OXYGEN SUPPLY

Three oxygen cylinders, are mounted on the left side of the cockpit aft of the captain's side console. The forward cylinder is used for the flight crew oxygen system and the aft two cylinders are used for the passenger oxygen system. Provisions are incorporated for installing a fourth cylinder which would be used to supplement the flight crew system.

An interconnect valve is installed in the system which permits the flight crew members to obtain oxygen from the passenger oxygen cylinders.

CAUTION

When the interconnect valve is opened, the pressures will equalize between the passenger bottles and the crew bottle. After the pressures have stabilized, as indicated by the bottle pressure gauges, be certain that the valve is then CLOSED as the crew oxygen supply could become depleted if this valve were left in the OPEN position and passenger oxygen was being used.

SMOKE GOGGLES

Smoke goggles are provided at all crew member stations. The goggles utilize an amber lens to improve visibility in smoke conditions and are designed to be worn with the individual crew supplemental oxygen masks.

Two small plastic tubes connected to the goggles, provide an air passage between the supplemental mask and goggles. These tubes are long enough to extend inside the supplemental mask when it is in place.

To use these goggles, proceed as follows:

Don the supplemental mask.
Put on smoke goggles and secure with the elastic headband.

Tip upper portion of the oxygen mask (nose cone) away from the face momentarily to allow goggle air tubes to assume the proper position beside the nose.

Reposition mask over nose and mouth making certain plastic tubes extend inside the mask.

Should it be necessary to clear the goggles (contaminated air or fogging), the oxygen regulator emergency valve may be used to provide continuous flow as required.

CAUTION

Extended use of continuous oxygen flow will rapidly deplete the oxygen supply.

K. PASSENGER OXYGEN SYSTEM

Automatic operation:

Two automatic opening, pressure reducing, continuous flow regulators are mounted adjacent to the passenger oxygen cylinders. The high pressure outlet line from each of the passenger oxygen cylinders is connected to its respective auto regulator. The cylinder outlet lines are also connected together so that in the event one auto regulator malfunctions, the other regulator will control the supply of oxygen to the passengers.

The auto regulators are designed to open automatically and release oxygen into the lines when the cabin altitude exceeds 14,500 (± 1,000) feet. At that time they will supply sufficient oxygen for the 14,500 foot level and the regulators will allow increasing flows for higher altitudes. Upon descent, after the valves have opened automatically, the regulators will supply oxygen appropriate for the various altitudes until the cabin reaches approximately the 8,000 foot level. At approximately 8,000 feet the regulators will close, stopping oxygen flow completely.

Manual Operation:

A manual override lever is provided on each auto regulator and is normally positioned off (horizontally). Raising one or both of the manual levers to the vertical position will cause the regulator to release oxygen to the lines.

The manual lever will supply the equivalent of the oxygen flow required at 20,000 feet (approx. 3 LPM) at any altitude BELOW 20,000 feet. ABOVE 20,000 feet the regulator again takes control and will increase the flow as necessary for the higher altitudes.

Mask Stowage Box:

The mask stowage box contains from one to three masks depending on its location. Three masks are available above each section of seats. In the coach section, passengers with lap children must be seated on the right side to ensure an oxygen mask is available to the infant. Two masks are stowed in the box at each lavatory and galley. One mask is stowed in the first class aisle stowage boxes. When oxygen is released, oxygen pressure actuates a pneumatic latch, which releases the stowage box door permitting the masks to fall within easy reach of the passengers. The stowage box door may also be released by manually operating the pneumatic latch. Releasing the door manually will not supply oxygen unless the oxygen system has been activated. When at a safe altitude, the pneumatic latch can be manually released in the event some of the panels did not drop out when the system was activated.

K. **PASSENGER OXYGEN SYSTEM**

Plastic tubes connect the passenger face masks to a rotary valve. When a mask is pulled down, it opens the rotary valve and permits oxygen to flow to that mask.

Passenger Oxygen Masks:

Each assembly consists of a cup shaped face mask with an elastic head band, an exhalation valve, a compensated safety and dilution inhalation valve, a plastic reservoir bag and connecting plastic tubing. The compensated safety and dilution valve automatically allows cabin air to be inhaled along with oxygen. The exhalation valve opens directly to cabin air during the time of exhalation. A picture is printed on each side of the reservoir bag to show the correct manner of placing the mask over the user's mouth and nose.

L. **CREW PORTABLE OXYGEN**

A portable oxygen bottle is located on the bulkhead to the right of cockpit door. To use, remove bottle from quick disconnect mount and don mask.

a. Open Shutoff Valve
The gauge indicates the pressure of the oxygen in the bottle and the amount of oxygen available for breathing. The bottle has an approximate duration of 14 minutes.

b. A shoulder strap is provided to facilitate carrying bottle throughout aircraft.

M. **PASSENGER PORTABLE OXYGEN**

Five portable oxygen bottles are located in the passenger cabin. The bottles are equipped with a pressure gauge, on/off valve, and two outlet connections. The low outlet on the low side of the gauge, provides a two (2) litre per minute flow for 146 minutes. The high outlet, marked with a red tape and located on the high side of the gauge, provides a four (4) litre per minute constant flow for 73 minutes.

One canvas bag, located near each bottle, contains three disposable oral nasal masks and a wrench. The wrench will assist, if necessary in opening bottle valve.

To operate the bottle:

a. Turn yellow knob left to on position.

b. Insert mask fitting forcibly into appropriate outlet, and turn right to lock.

c. Check for flow.

d. Strap mask on passenger.

e. Start changing bottles at 500 psi.

N. **EVACUATION SIGNAL**

The Evacuation Signal Alarm Panel is an additional means of alerting the entire crew for an evacuation. There are three panels in the airplane; one on the captain's overhead panel, one at the forward and one at the aft cabin attendant stations.

The panels contain a flashing red light, high frequency pulsating horn signal, a guarded command switch and a horn shutoff switch. Turning any command switch on activates the flashing red lights and pulsating horn signals at all panels. This notifies all crew members that an evacuation has been started. The system is activated as long as any command switch in the aircraft is "ON." Pushing the horn shutoff button silences the horn only at that panel.

All flashing lights will remain ON as long as any command switch is in the "ON" position.

O. **ESCAPE SLIDE EMERGENCY LIGHTS**

Emergency lights are installed on all aircraft doors which will illuminate a deployed escape slide.

Each light is a completely independent system. Each light contains its own individual battery, which is automatically activated whenever the escape slide panel is dropped to the floor. This is accomplished by pulling a plug out of a socket fitting located inside the slide housing. It takes approximately five (5) seconds for the light to attain full brightness.

The installation does not require a crew member preflight.

* * *

* * *

ENGINE BLEED VALVE CLOSED LIGHTS ON

One or more engine bleed valve closed lights on in flight is normal. However, if the lights indicate one valve staying closed continuously, its condition can be checked by closing other bleed valves which will force it to open. Caution should be observed when conducting this check to prevent any adverse effect on cabin pressurization.

If a bleed valve does not open when the other bleed valves are closed, a logbook writeup should be made.

B. HIGH DUCT PRESSURE LIGHT ON

The red high duct pressure light ON normally indicates that a bleed valve is stuck open or is failing to regulate properly. Rapid acceleration of the engines when bleed air usage is low can cause the red light to come on momentarily. This is normal and should not cause concern.

If the high duct pressure light comes on in flight, accompanied by three bleed valve closed lights, turn off the bleed valve switch under the light that is out. The high duct pressure light should go out and the remaining bleed valves should open to supply the bleed air requirements.

C. ENGINE BLEED VALVE MALFUNCTIONS

Bleed air requirements are not always heavy enough to cause all bleed valves to open. A bleed valve that has a high regulated pressure setting may supply all the bleed air when bleed air usage is low, but should not be considered to be hogging the load unless the following conditions exist.

1. Required thrust cannot be set without exceeding published EGT limits.
2. Maximum EGT spread between engines exceeds 30°C.
3. All bleed valves do not open or EGT does not stay within limits when the turbocompressors, rain clear and wing anti-icing systems are operated simultaneously.

If any or all of the above conditions exist, write up the malfunctioning valve as hogging the load.

D. VERIFICATION OF ISOLATION

An excess heat light on the isolation panel indicates that an overheat has energized the isolation relay for the area, but does not necessarily mean that all valves have closed to isolate bleed air from the area.

If the area has been isolated, the excess heat light should go out when the isolation switch is placed to off. Other indications are usually evident to verify isolation. A wing isolation is normally obvious due to the loss of one turbocompressor and the resultant increase in cabin altitude. If the turbocompressor on the affected side is not in use, the isolation can be verified by turning on wing anti-ice. The three wing anti-ice valve closed lights for that side should come on if the area has been isolated. A fuselage isolation that occurs when rain clear is not being used is easily verified by turning on rain clear.

E. FAILURE TO ISOLATE

If an overheat occurs in any area protected by the isolation system and an automatic isolation does not occur, the area must be isolated manually.

1. If a wing area fails to isolate when an overheat occurs:
   a. Place wing isolation switch to off. If bleed valve closed lights are on and area is still not isolated,
   b. Place fuselage isolation switch to off. Opposite isolation valve should close and isolate the area.
2. Fuselage fails to isolate - Rain Clear On.

   If the fuselage excess heat light does not go out when the fuselage isolation switch is placed to off, one or both of the isolation valves have failed to close. Determine the faulty valve by the following procedure.

   Turn off the turbocompressor and close the bleed valves on one side. If the rain clear airflow stops, the isolation valve on that side is at fault. Continue flight in this configuration.

   If rain clear airflow continues, restore bleed air and turbocompressor operation on that side and repeat the procedure on the other side. If flight is continued with one wing and the fuselage isolated, turn recirculation fan on and close electronic equipment cooling valve.
3. Fuselage fails to isolate - Rain Clear Off.

   If the fuselage excess heat light does not go out when the fuselage isolation switch is placed to off, place the rain clear switch to on and repeat the procedure in E-2.

F. MANUAL OPEN POSITION OF ISOLATION SWITCHES

Use of the MAN OPEN position of the isolation switches should occur only when it is imperative that bleed air be made available for some system after an isolation has occurred.

The fuselage switch can be placed to MAN OPEN to provide bleed air for rain clear during approach with some degree of safety because of the lower engine power settings in use at this time. Any time an isolation switch is operated in MAN OPEN, the temperature of the area should be monitored with the temperature indicator on the leading edge and duct space panel.

The wing isolation switches should not be operated in MAN OPEN unless the captain considers the need for bleed air critical enough to justify possible overheat damage to the wing leading edges and adjacent structural members.

G. MALFUNCT LIGHT ON WITH ENGINE ANTI-ICE ON

A malfunct light on with engine anti-icing on and the engines at idle is normal. If the engine RPM is above 75%, either the engine inlet or the nose cowl valve has failed to open. Failure of the nose cowl valve can be identified by a visual inspection of the nose cowl if icing conditions exist. Failure of the engine inlet valve can usually be verified by the absence of an oil temperature increase after engine anti-icing is turned on.

If the valves appear to be open but the malfunct light remains on, the pressure switch is probably stuck in its low pressure position. Continue normal operation of the engine and enter the malfunction in the aircraft logbook.

MALFUNCT LIGHT ON WITH ENGINE ANTI-ICE ON

If one or both valves are actually malfunctioning and anti-icing is not available to a part of the engine, operation in icing conditions should be avoided whenever possible.

MALFUNCT LIGHT ON WITH ENGINE ANTI-ICING OFF

Failure of the engine inlet anti-ice valve to close when anti-icing is turned off, or a pressure switch stuck in the high pressure position, are the only malfunctions that will cause the malfunct light to come on when the engine anti-ice is turned off.

If a definite oil temperature drop is noted after engine anti-icing is turned off, the light is probably due to a malfunctioning pressure switch.

If the oil temperature does not drop, the engine inlet anti-ice valve has remained open. Extreme caution should be observed as the engine front frame can be damaged by overheat.

If ram air temperature is below +15°C, the engine can be operated continuously with the valve open.

When ram air temperature is above +15°C, and the engine inlet anti-ice valve is stuck open, do not operate the engine for more than 5 minutes at any power setting above idle and for more than 20 minutes at idle. If these conditions cannot be met, consider shutting down the engine.

I. WING ANTI-ICE VALVE CLOSED LIGHT ON

A wing anti-ice valve closed light on with the wing anti-ice switch on indicates the respective valve is closed. If the temperature indicated by the leading edge temperature indicator is below 267°F, the valve should be open. The following procedure can be used to determine the nature of the malfunction.

1. Pull the correct (left or right) WING SKIN TEMP OVERHEAT circuit breaker B-5. If the valve opens, the problem is in the overheat circuit. If the valve does not open, the anti-ice valve is bad. In either case, the proper logbook writeup should be made.

J. WING ANTI-ICE VALVE HUNG OPEN

A wing anti-ice valve hung open when the switch is off will probably be indicated by an excess heat light on the leading edge and duct space panel. A high temperature will be indicated on the gauge when selected to the proper skin patch sensor.

If repeated operation of the wing anti-ice switch does not cause the valve to close, the wing should be manually isolated to protect the leading edge against overheat damage.

K. USE OF WING ANTI-ICE AFTER WING ISOLATION

If wing anti-ice is required after a wing has been isolated, the following procedure is recommended.

1. Place wing isolation back to AUTO.
2. Locate the hot spot with the leading edge and duct space temperature indicator and selector, if possible.
3. Leave the isolation switch in AUTO until the wing is cleared of ice, then place switch back to OFF. Cycle switch between OFF and AUTO as necessary to keep wing cleared of ice.
4. If a hot spot is located with the selector, the temperature should be monitored and isolation switch placed from AUTO to OFF if it becomes excessive. This will not normally occur before the wing is cleared of ice.

   The turbocompressor on the affected side must be turned off to prevent cabin pressure surges.

L. LEADING EDGE & DUCT SPACE TEMPERATURE LIGHT ON IN FLIGHT

Use the temperature selector to locate the hot spot.

1. If the hot spot is located at one of the first six positions (1 thru 6) and wing anti-icing is in use:
   a. Turn wing anti-icing off, if not required.
      If light goes out, leave wing anti-icing off.
2. If wing anti-icing is not on or light remains on with wing anti-icing off:
   a. Manually isolate the wing.
      Turbocompressor on that side should be turned off. Place equipment cooling switch to FAN ON or turn on an alternate pressure source.
3. If the hot spot is located at a duct space position (7 - 11 or or 14 - 18)
   a. Manually isolate the wing.
      Correct for pressurization loss.
4. If the hot spot is at a fuselage position (12 or 13).
   a. If rain clear is on:
      Turn rain clear off as soon as practical.
   b. If rain clear is off.
      Manually isolate the fuselage. Check the floor above the electronics and forward cargo compartment for hot spots which would indicate a fire in the area.

M. FAILURE OF ANTI-FOG HEAT

Anti-ice heat can be substituted for anti-fog heat on the three forward panels provided the windshield heat limitations in chapter 01 of this manual are observed. 'Temperature of the windshields is maintained at the same level with the switches in either position.

N. AIRCRAFT DISPATCHED WITH CRACKED WINDSHIELD OR BUBBLES BETWEEN LAYERS

Maintenance may release an aircraft for flight with a crack in the non structural outer glass layer or bubbles between the layers if the following conditions are met.

1. Captain determines cracks or bubbles do not restrict visibility.
2. Cracks are confined to outer layer only and inner structural layers are sound.
3. Windshield heating requirements as specified in the inoperative equipment list are met.

O. **CYCLING OF WINDSHIELD RAIN CLEAR VALVE**

If rain clear shuts off or cycles on and off during normal low power descent or approach, the following procedure is recommended.

1. Pull circuit breaker B-5 placarded RAIN CLEAR OVERHEAT CONTROL.
2. Use rain clear only when needed.
3. Reset breaker for go-around or after landing.

If rain clear shuts off or cycles slowly enough to be ineffective during normal use on takeoff, the above procedure can be used. Reset the circuit breaker when rain clear is no longer needed.

P. **IMPROVEMENT OF RAIN CLEAR OPERATION**

The following actions will aid in improving the effectiveness of rain clear for landing.

1. Turn rain clear on near the outer marker to clear the ducting of possible water.
2. Depressurize the cabin at a slightly higher altitude than normal and turn the last turbocompressor off sooner than normal.
3. Turn wing and engine anti-ice off, before touchdown.
4. Reduce engine power with minimum abruptness for least disturbance of bleed air flow.

Q. **USE OF RAIN REPELLENT WITH RAIN CLEAR**

If rain repellent is used in conjunction with rain clear, the following procedure is recommended.

1. Turn rain clear on early to clear ducting, then turn off.
2. Apply rain repellent to both windshields.
3. Turn rain clear on, if desired.

R. **PITOT STATIC OR SCAT INDICATOR LIGHT FAILURE IN FLIGHT**

Cycling of static heat indicator lights in flight is normal.

If a pitot or Scat indicator light goes out in flight, leave switches on as each switch controls more than one system. Also, the control circuit for the light may be the only part that is at fault and heat may still be available to the unit. Monitor airspeed indicator carefully if pitot heat indicator light is inoperative.

* * *

A. ENGINE BLEED AIR

HIGH DUCT PRESS. INDICATOR LIGHT

Indicates manifold pressure is excessive.

C9 - HIGH DUCT PRESS WARN LT.

BLEED VALVE CLOSED INDICATOR LIGHTS

Indicates bleed valve is closed.

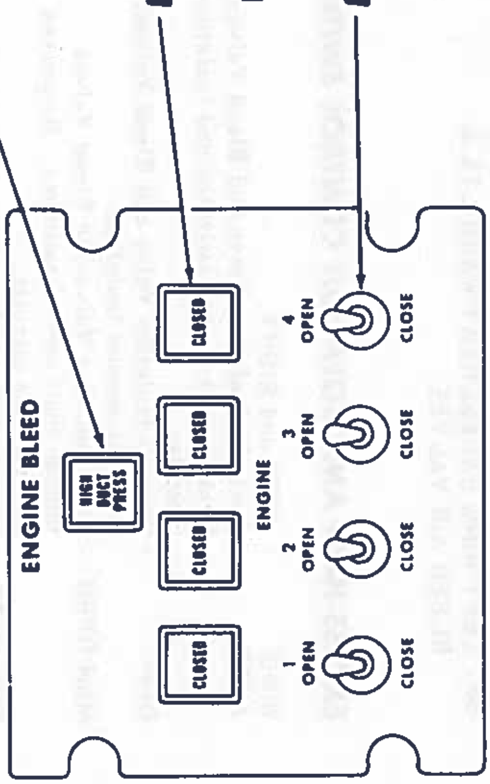
B7 - BLEED VALVE IND LTS.

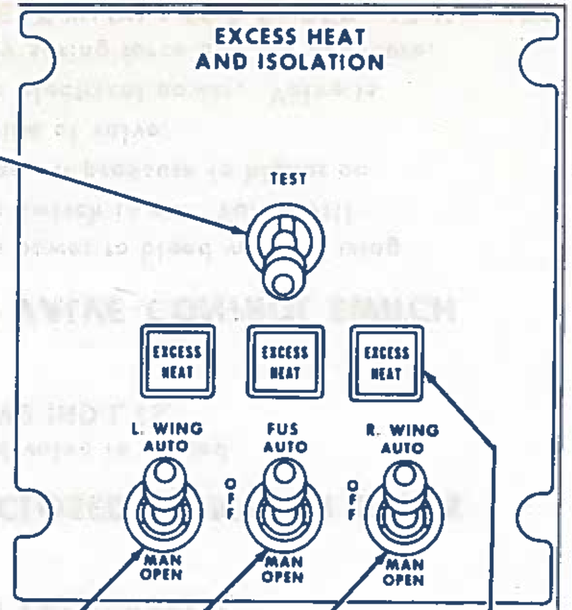
ENGINE BLEED VALVE CONTROL SWITCH

OPEN - Provides power to bleed valve if wing isolation switch is on. Valve will open when air pressure is higher on engine side of valve.

CLOSE - Removes electrical power. Valve is closed by spring force and air pressure.

B6 - EXCESS HEAT WARN LTS & BLEED AIR VALVES.





EXCESS HEAT AND ISOLATION TEST SWITCH

TEST - Provides excess heat signal to wing and fuselage loops when on the ground.

B6 - LEFT WING EXCESS HEAT WARN LTS & BLEED AIR VALVES.

EXCESS HEAT AND ISOLATION CONTROL SWITCHES

WING - LEFT and RIGHT

AUTO - Arms the Isolation Valve and Bleed Valves through their control switches and isolation circuits.

OFF - Disarms Isolation Valve and Bleed Valves. Provides manual isolation.

MAN OPEN - Arms Isolation Valve and Bleed Valves through their control switches. By-passes the isolation circuits.

FUS AUTO - Arms Isolation valves through the wing isolation switches and wing and fuselage isolation relays.

OFF - Disarms Isolation Valves. Provides manual isolation.

MAN OPEN - Arms Isolation Valves directly. By-passes the isolation circuits.

B6 - LEFT WING - "L.H. Bleed Valves and L.H. Excess Heat Light", "L.H. Isolation Valve.
RIGHT WING - "R.H. Bleed Valves and R.H. Excess Heat Light", "R.H. Isolation Valve and Fuselage Excess Heat Light".

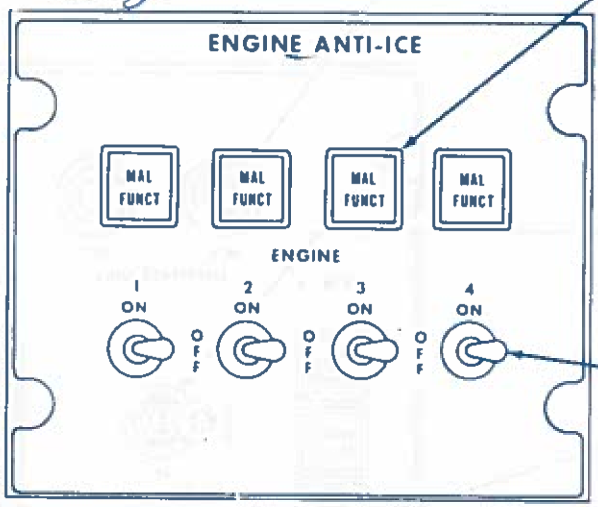
EXCESS HEAT INDICATOR LIGHTS

Indicates any time loop senses excessive temperature and during test of system if loop is in tact. Light remains on until switch is placed OFF and loop has cooled.

B6 - EXCESS HEAT WARN LTS & BLEED AIR VALVES; R.H. ISOLAT & FUS EXCESS HEAT LT.

C. ENGINE ANTI-ICE

lights are armed at all times



MALFUNCTION INDICATOR LIGHTS

Indicates with switch ON:

a. Nose cowl valve failed to open.

b. Pressure is low at inlet pressure switch due to compressor inlet valve failing to open or low engine RPM.

Indicates with switch OFF:

Compressor inlet valve failed to close.

B7 - DUCT LIP VALVE IND LTS.

ENGINE ANTI-ICE CONTROL SWITCHES

ON - a. Energizes solenoids in two engine anti-ice valves, air pressure opens valves.

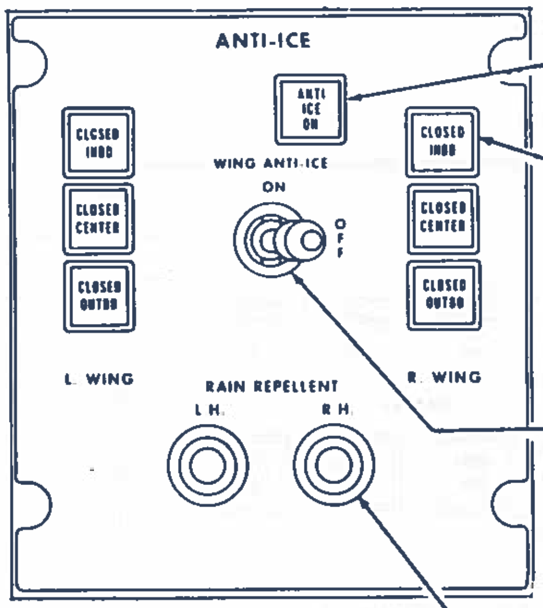
b. Turns anti-ice light ON.

OFF - De-energizes solenoids in both engine anti-ice valves. Valves are closed by spring force and air pressure.

B8 - GUIDE VANE AND NOSE CONE A-I VALVE.

B7 - DUCT LIP VALVE IND LTS.

D. WING ANTI-ICE



ANTI-ICE ON INDICATOR LIGHT

Indicates an engine or wing anti-ice switch is ON.

B5 - ANTI-ICE LIGHTS.

WING ANTI-ICE VALVE CLOSED INDICATOR LIGHT

Indicates valve is closed with switch ON.

B5 - ANTI-ICE CONTROL - L. WING - R. WING.

WING ANTI-ICE CONTROL SWITCH

ON - Energizes wing anti-ice valves, air pressure opens valves.

OFF - De-energizes wing anti-ice valves, air pressure and spring force close valves.

B5 - ANTI-ICE CONTROL - L. WING - R. WING.

RAIN REPELLENT PUSH BUTTONS

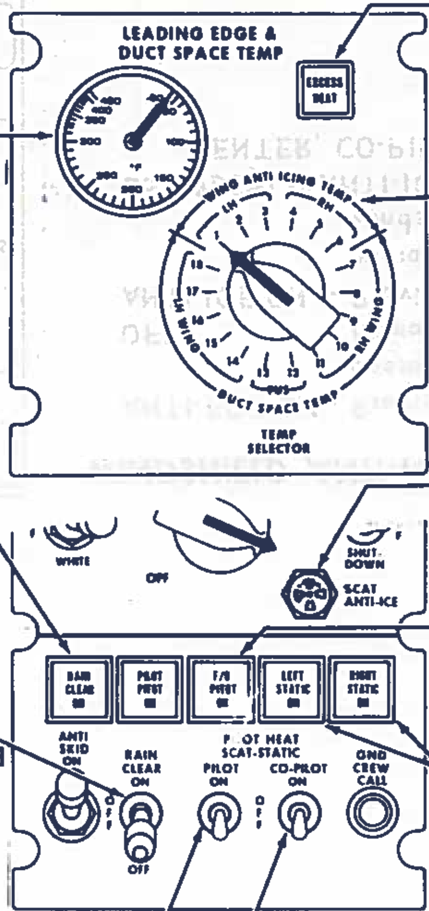
DEPRESSED - Energizes control valves to discharge fluid to that windshield.

A5 - RAIN REPELLENT - LEFT & RIGHT.

F. LEADING EDGE AND DUCT SPACE TEMP, RAIN CLEAR, SCAT AND PITOT HEAT

TEMPERATURE INDICATOR

Indicates temperature of sensor selected with the temperature selector.
B4 - STRUCT TEMP IND.



EXCESS HEAT INDICATOR LIGHT

Indicates when any skin patch or duct space sensor reaches a pre-determined temperature.
B6 - STRUCT OVERHEAT WARN.

TEMPERATURE INDICATOR SELECTOR

Positions 1 through 6 - Skin Patch sensors in Wing Leading Edge Skin.
Positions 7 through 11 and 14 through 18 - Duct Space sensors along Wing Manifold.
Positions 12 and 13 - Duct Space sensors along rain clear duct.
B4 - STRUCT TEMP IND.

SCAT ANTI-ICE INDICATOR LIGHT

Indicates current is flowing through the SCAT lift transducer heater.
B4 - PITOT HEATER LTS.

RAIN CLEAR INDICATOR LIGHT

Indicates that rain clear valve is open.
B5 - WDSHLD RAIN CLEAR VALVE.

PITOT HEAT ON INDICATOR LIGHT

Indicates current is flowing through the pitot heater.
B4 - PITOT HEATER LTS.

*

RAIN CLEAR VALVE CONTROL SWITCH

ON - Arms rain clear valve. Valve is opened by air pressure. Deactivates electric heat to Pilot and Co-Pilot windshields. *

OFF - Disarms valve and valve is closed by spring force and air pressure. *

B5 - WDSHLD RAIN CLEAR VALVE.

LEFT & RIGHT STATIC PORT HEATER INDICATOR LIGHTS

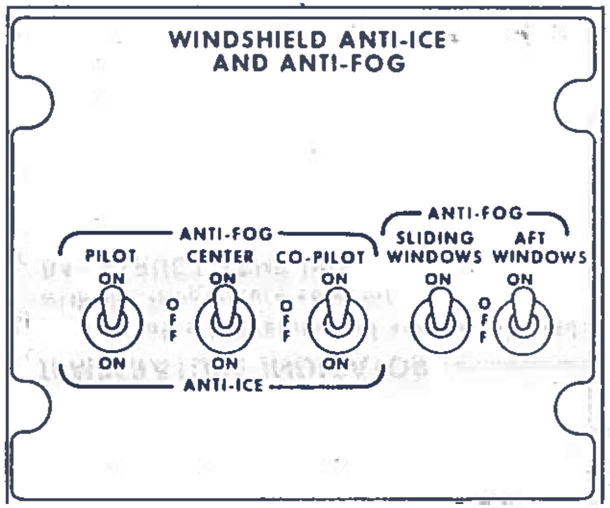
Indicate current is flowing through the static port heaters.
B4 - PITOT HEATER INDICATOR LIGHTS

PILOT'S PITOT HEAT CONTROL SWITCH

Controls power to Pilots pitot heater and SCAT lift transducer heater.
B4 - PITOT TUBE HEATER, PILOT, LIFT TRANSD HEATER 28V A.C. - GND.
B7 - LIFT TRANSD HEATER 115V A.C. - FLT.

CO-PILOT'S PITOT HEAT CONTROL SWITCH

CONTROLS POWER TO CO-PILOT'S PITOT HEATER & LEFT & RIGHT STATIC PORT HEATERS.
B4 - PITOT TUBE HEATER - CO-PILOT.
B7 - STATIC PORT HEATER.



WINDSHIELD ANTI-ICE AND ANTI-FOG CONTROL SWITCH

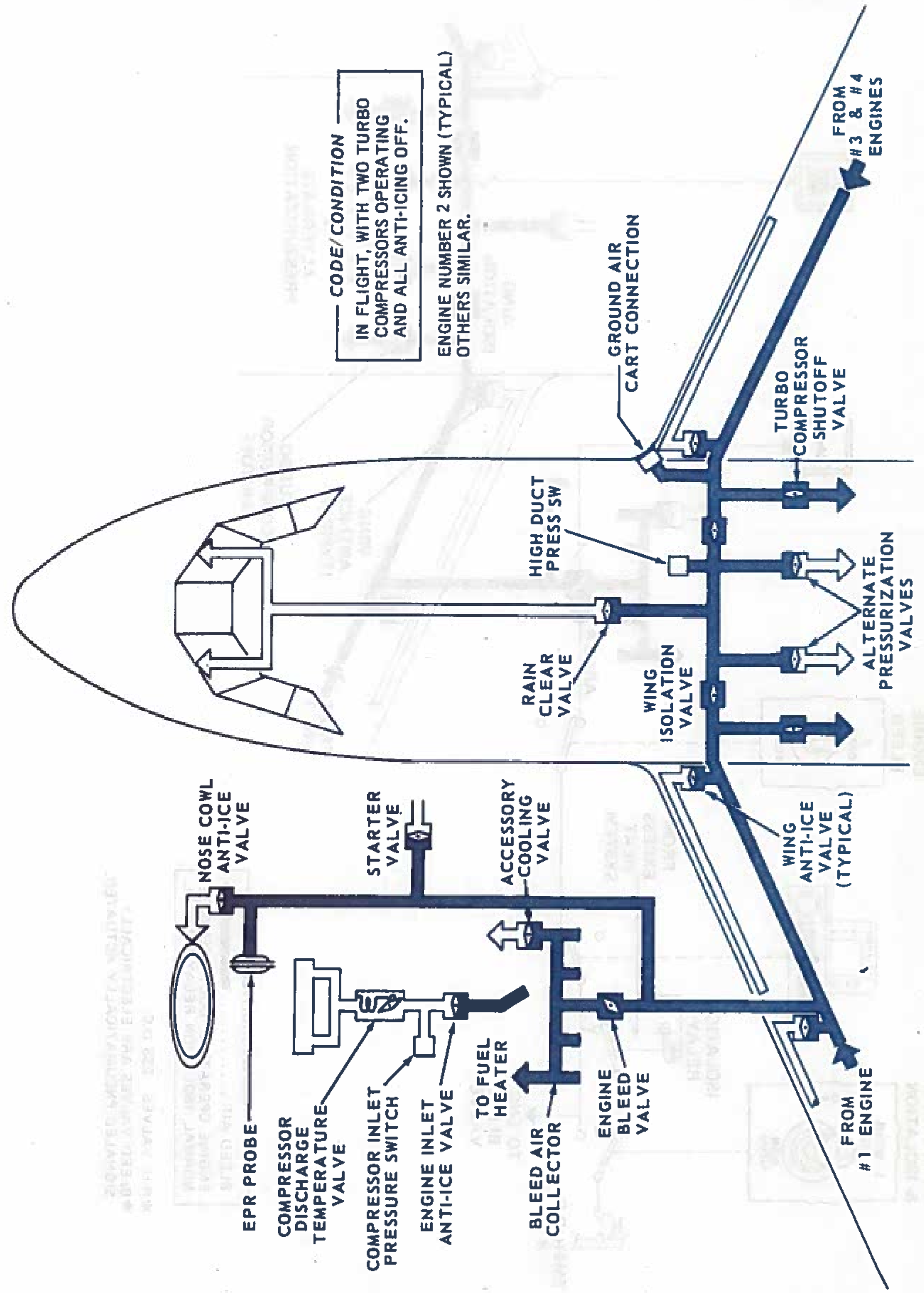
ANTI-FOG ON - Provides electric heat for anti-fog operation of all windshield panels.

OFF - Removes electric heat.

ANTI-ICE ON - Provides electric heat for anti-ice operation on the three forward windshield panels.

B5 - WDSHLD ANTI-ICE & DE-FOG, PILOTS, CENTER, CO-PILOTS, SLIDE, AFT.

A. BLEED AIR



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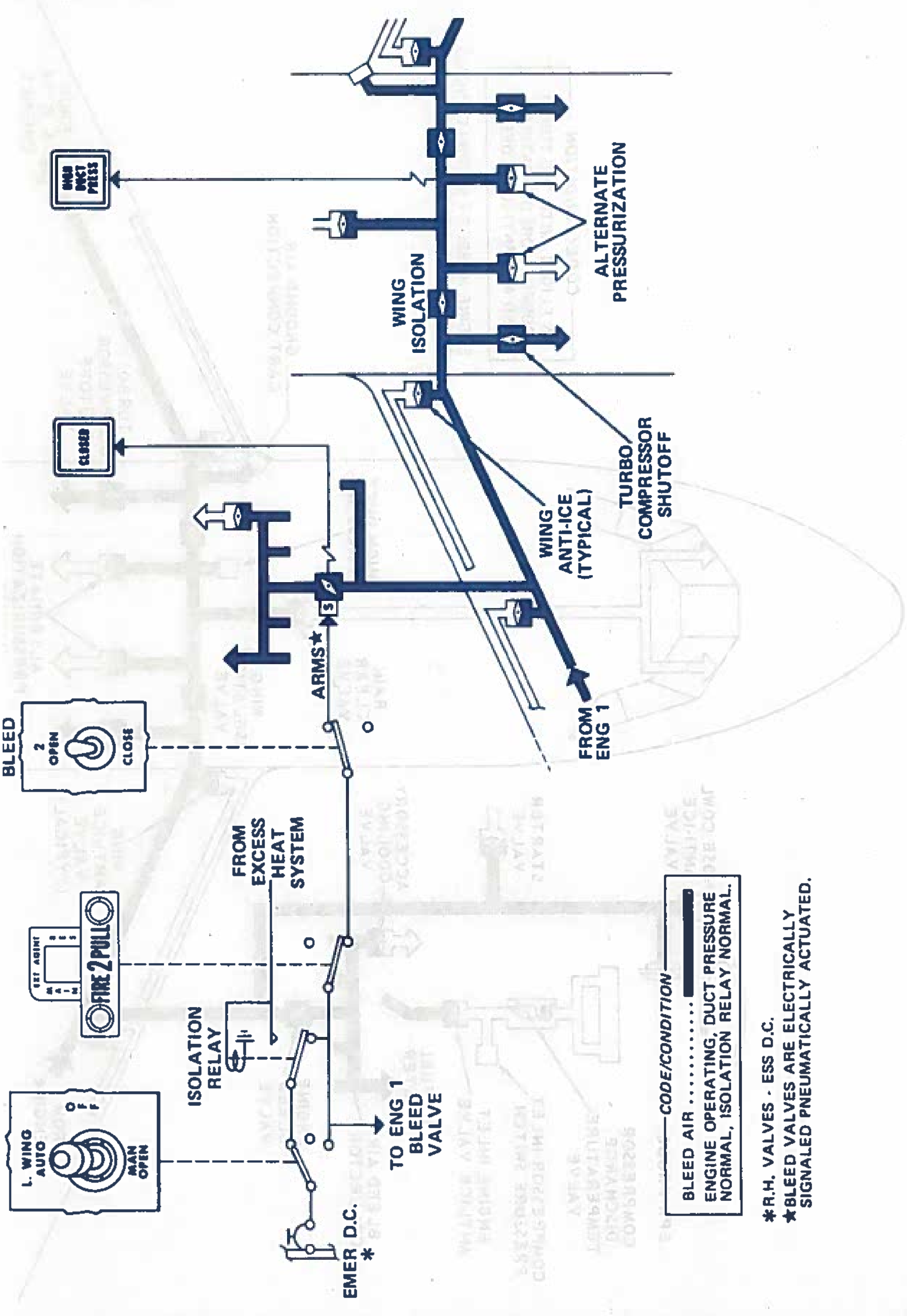
ENGINE BLEED SYSTEM OPERATION



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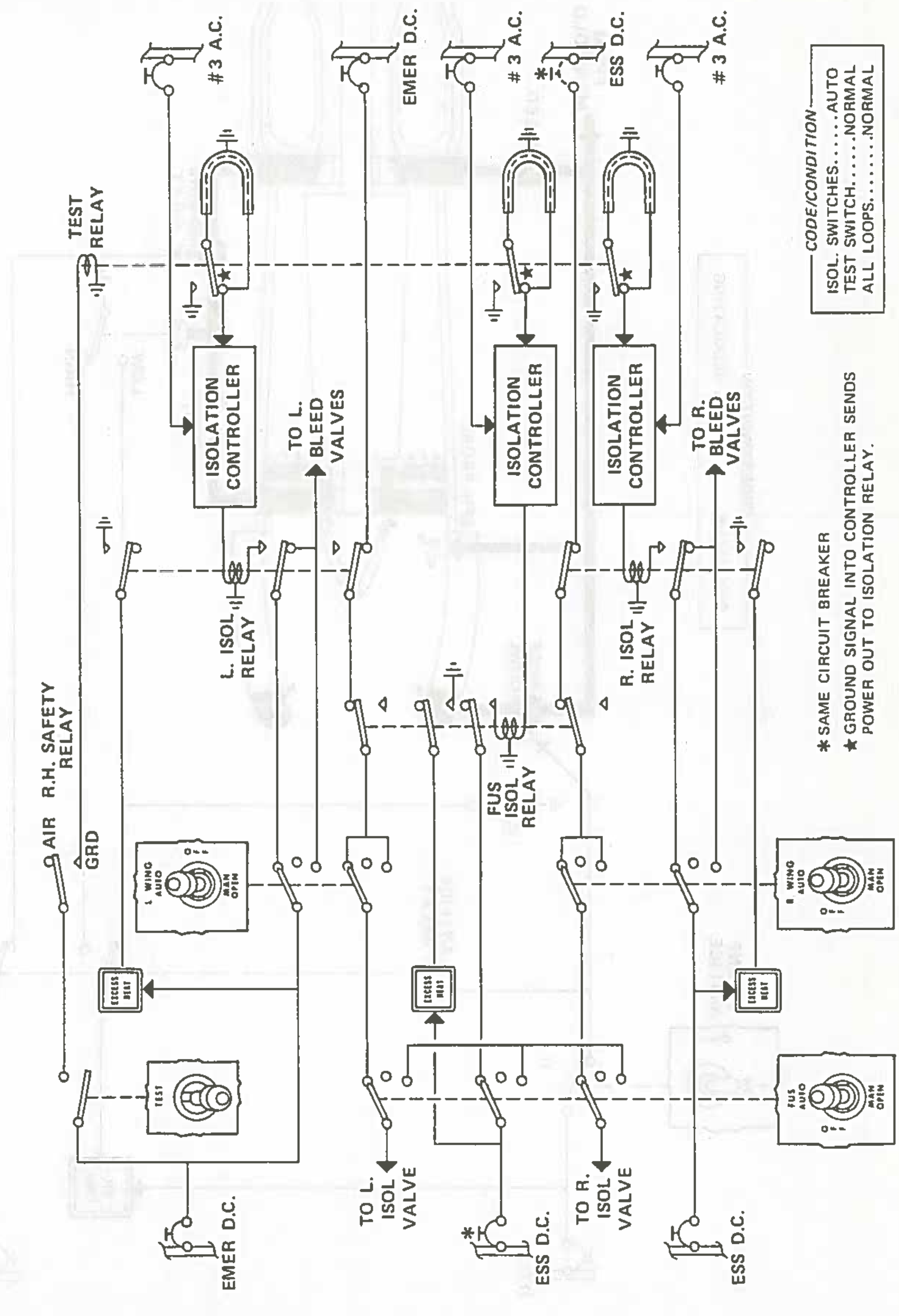
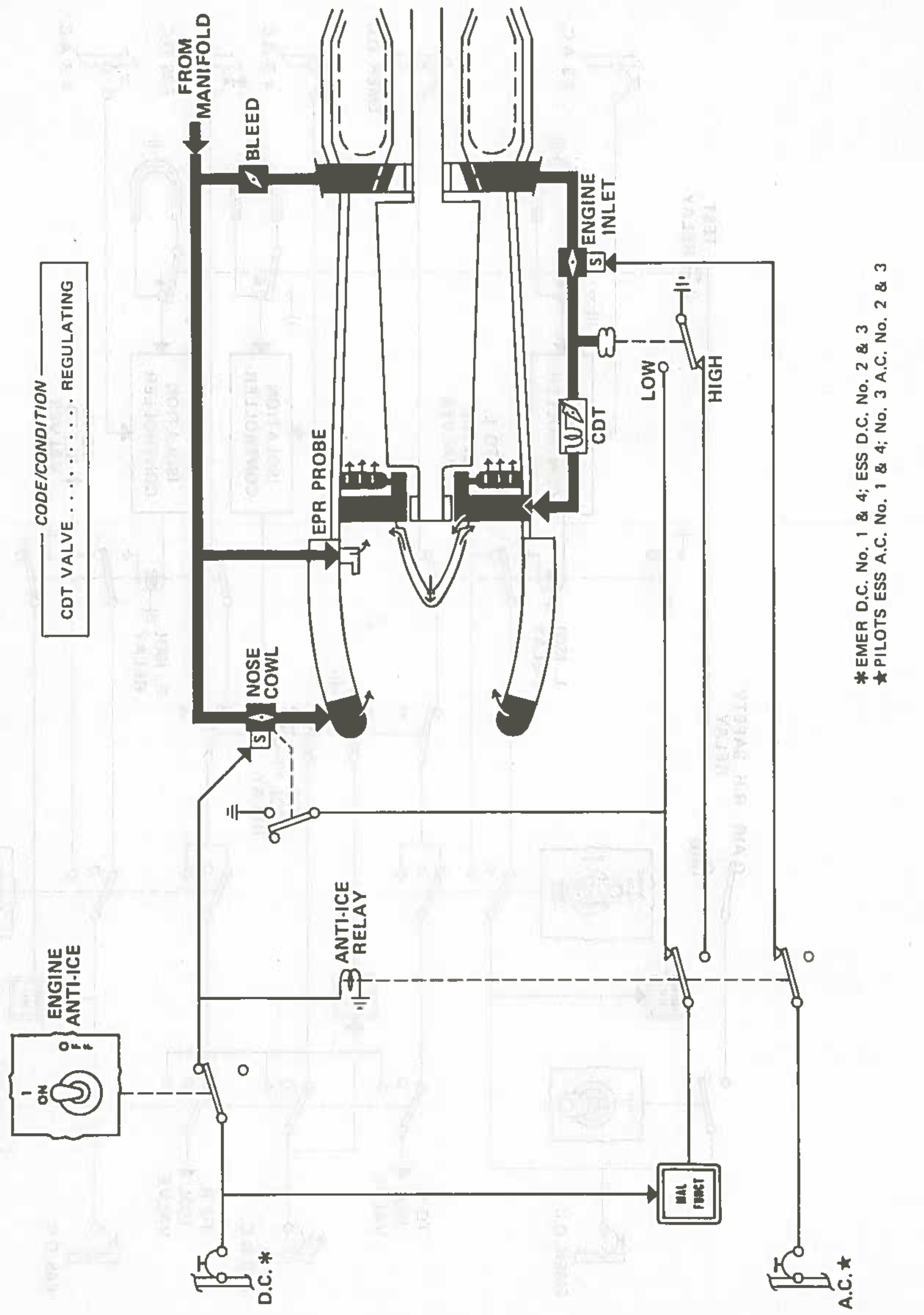
EXCESS HEAT AND ISOLATION



ENGINE ANTI-ICE



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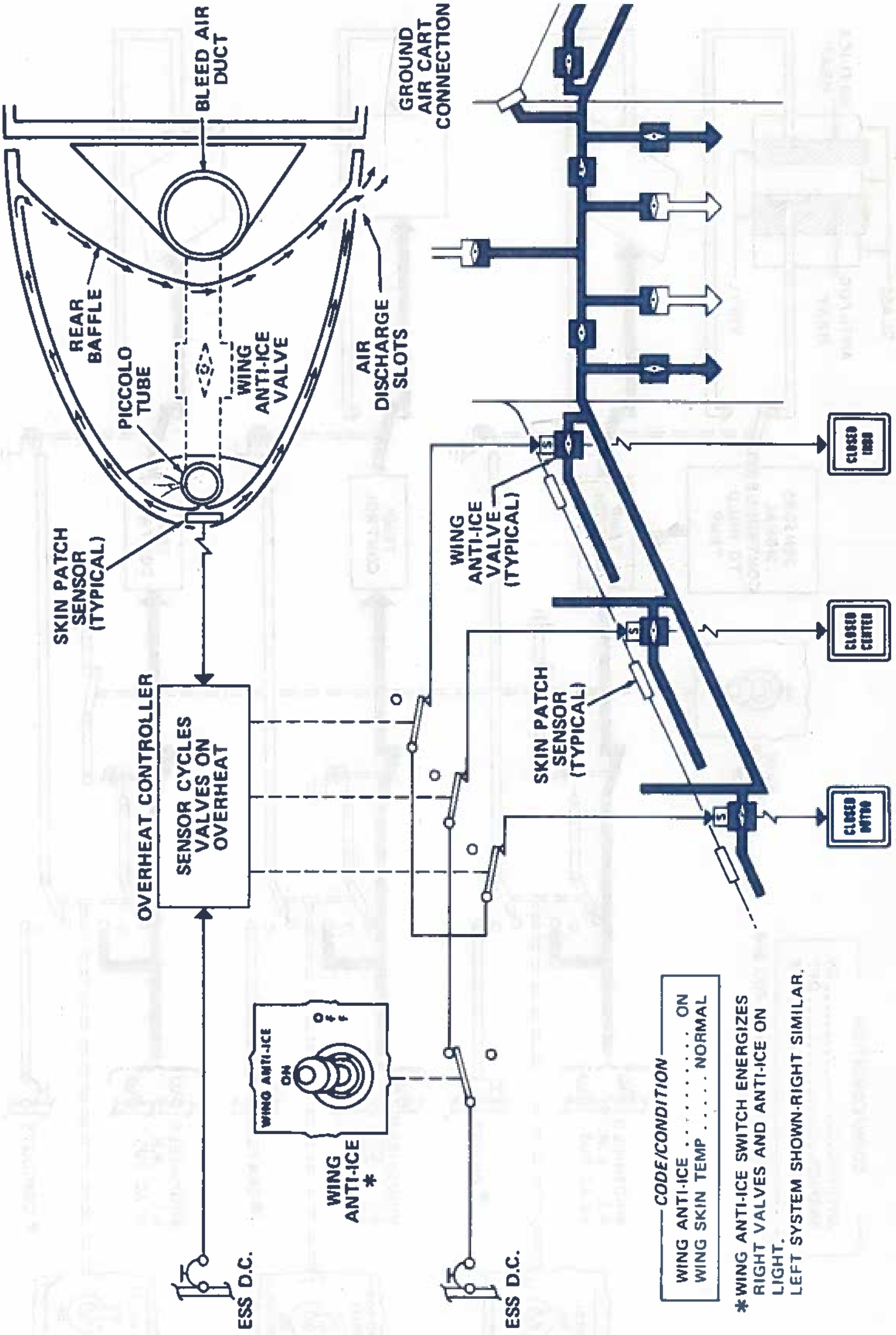
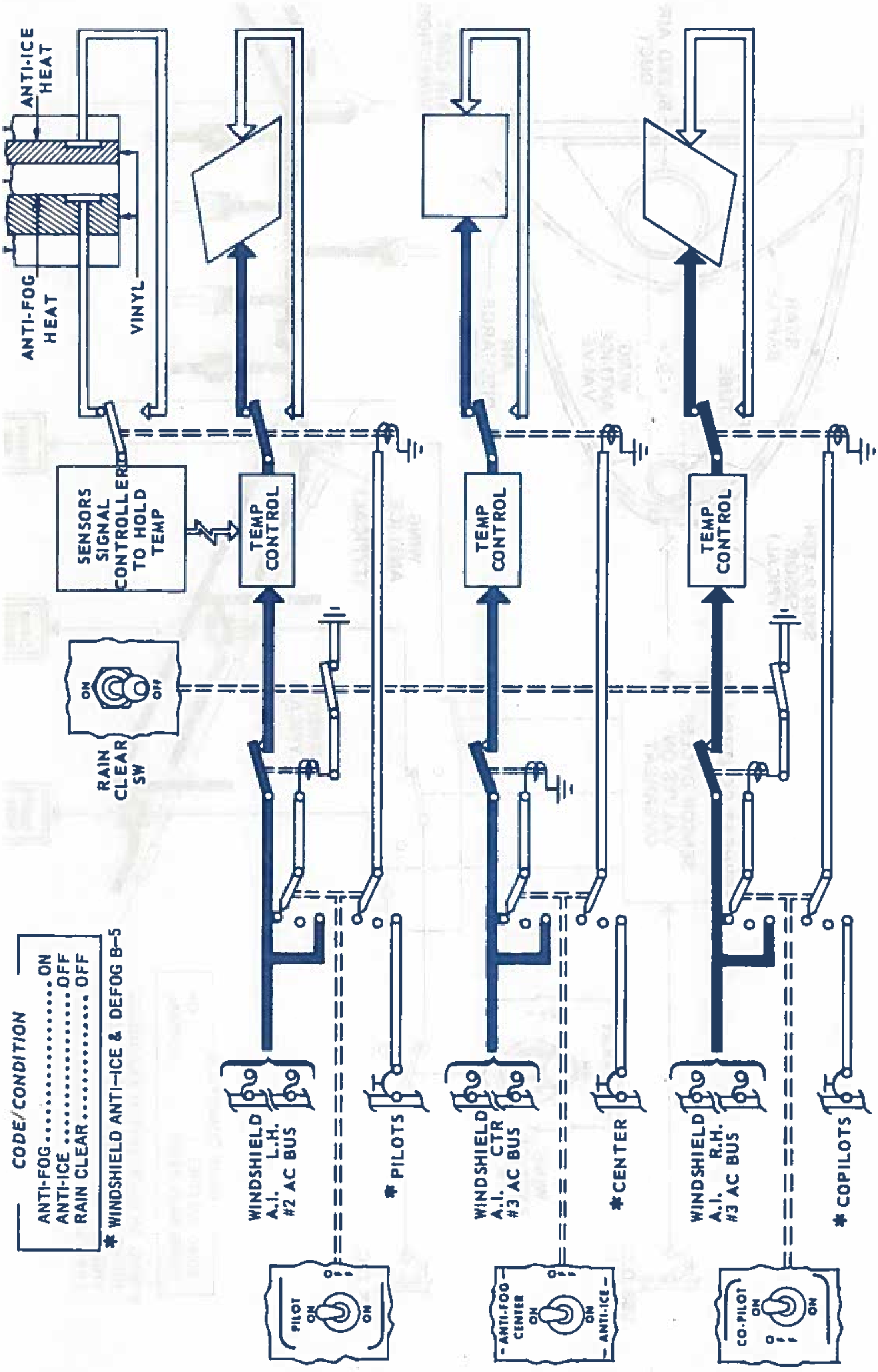
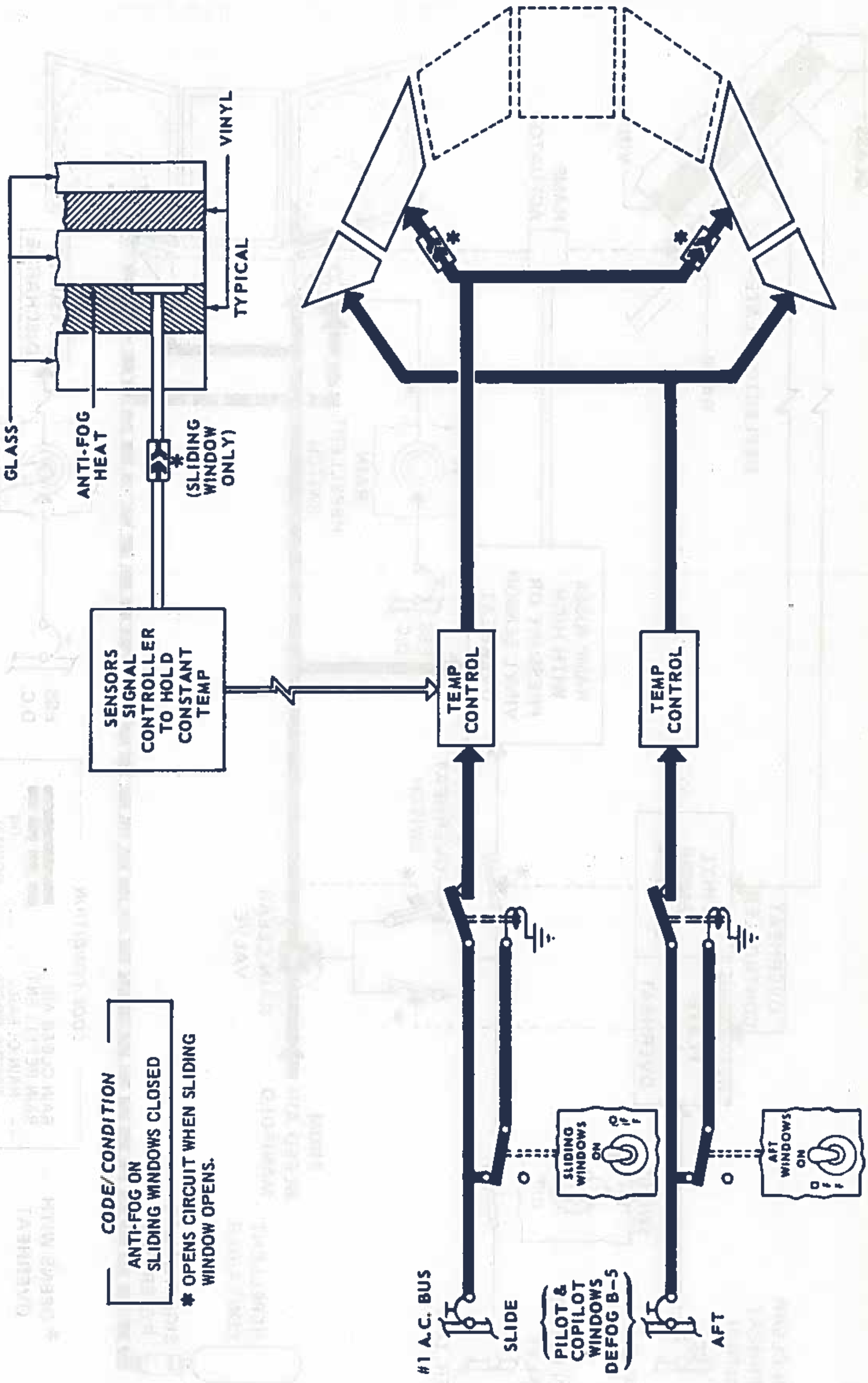
E. WING ANTI-ICE CONTROL



WINDSHIELD HEAT



G. WINDOW HEAT



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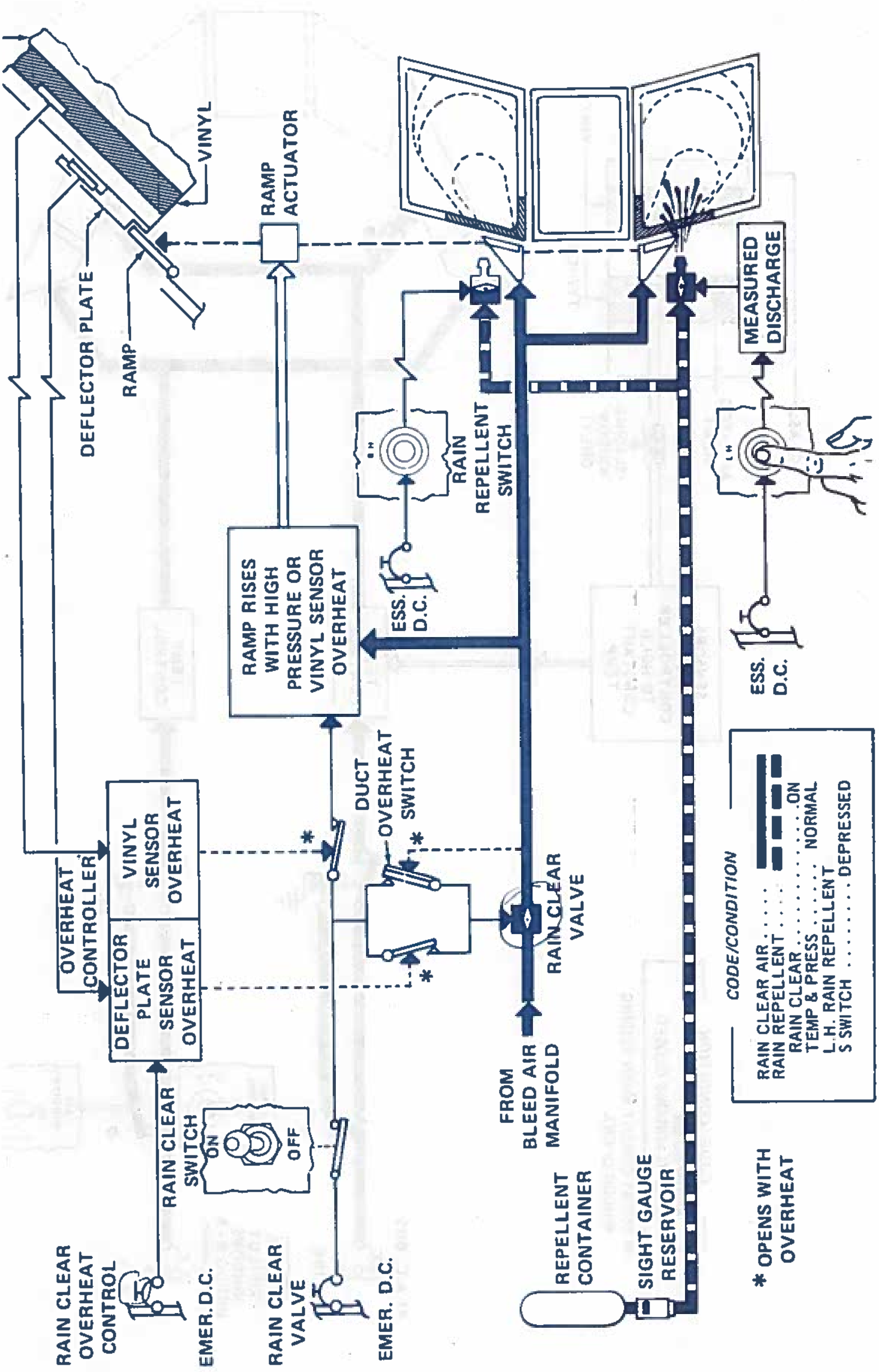
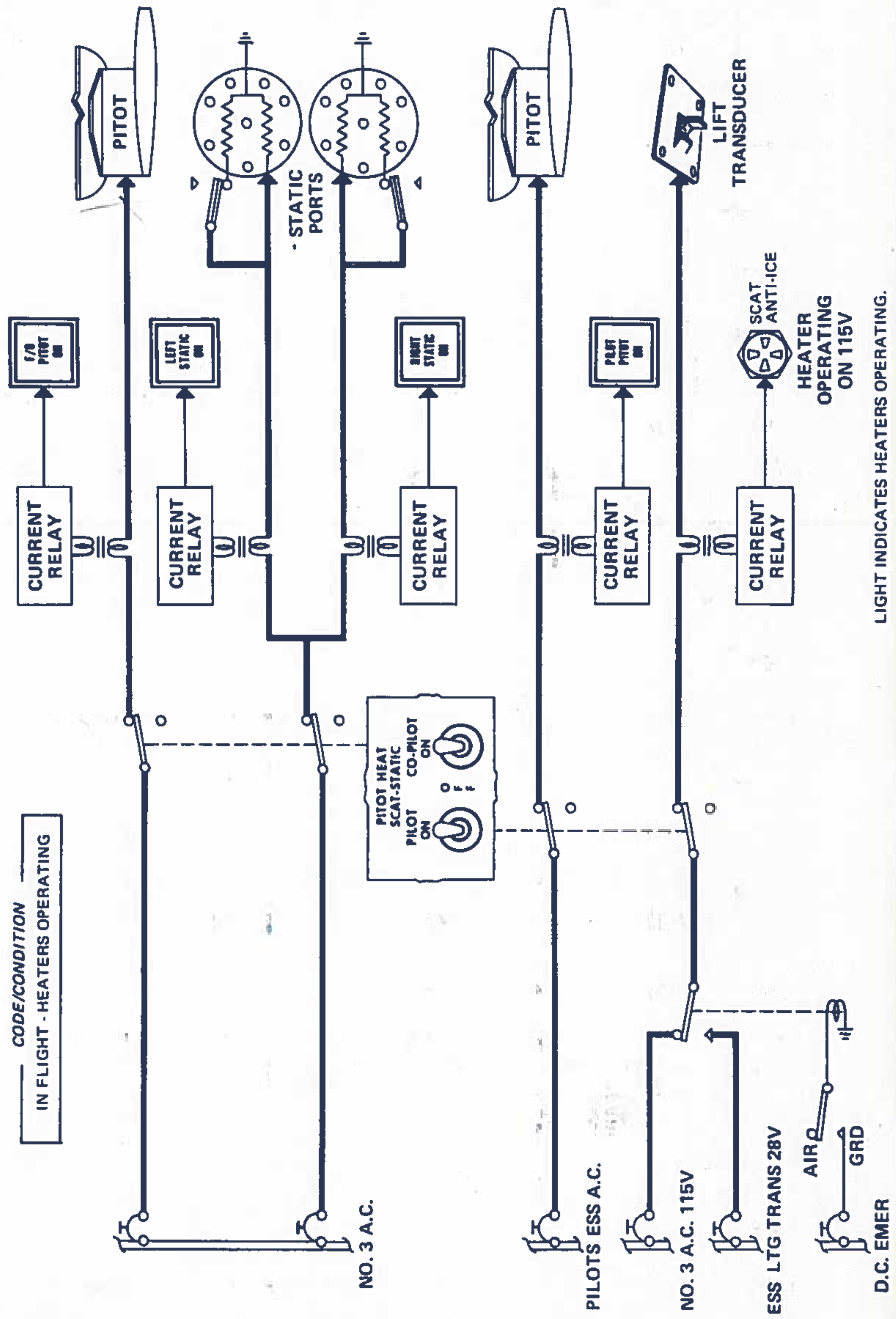
RAIN PROTECTION SYSTEMS



I. SCAT, STATIC & PITOT HEAT



A. GENERAL

De-icing, anti-icing and rain clearing provisions for the entire aircraft are as follows:

Engine Compressor Inlet - Bleed Air Anti-Iced
Engine Nose Cowl (Duct Lip) - Bleed Air Anti-Iced
Engine EPR Probe - Bleed Air Anti-Iced
Wing Leading Edge - Bleed Air Anti-Iced
Windshields (Two Main) - Rain Cleared by Engine Bleed Air
Cockpit Glass Panels (All) - Electrically (conductive panel) Anti-Fogged
Windshields (Three Forward) - Electrically (conductive panel) Anti-Iced
Pitot Probes, Static Ports and Scat Lift Transducer - Electrically Heated

Cockpit panel anti-fog will be on continuously for glass bird-proofing. Other systems will be turned on when required. Wing anti-ice is not used on the ground.

The potential danger of overheating structure from anti-icing air or leaking bleed air was recognized and various preventative measures taken. Certain critical areas are monitored by temperature sensors having warning light indication and by a temperature indicator through a selector. Some of these sensors, in the wing leading edge, also automatically cycle the anti-ice valves which supply bleed air to their area. Continuous loop detectors along bleed air ducts will upon sensing an overheat isolate the area by automatically stopping bleed air flow to it. EXCESS HEAT lights for these systems and CLOSED lights for most air valves provide operating information.

All control switches, lights, etc., for these systems are on the pilots' overhead panel.

Since most of these systems are dependent upon bleed air and since bleed valves operate as part of the excess heat and isolation system covered in this chapter, the bleed air system will be covered in its entirety within this chapter.

B. ENGINE BLEED AIR

The engine bleed air system consists of a modulating butterfly type bleed valve on each engine, two fuselage isolation valves and a bleed air manifold that extends from one outboard engine to the other, connecting all bleed valves. Most systems using bleed air are supplied from the manifold, although a few items such as engine inlet anti-icing, fuel heat and accessory cooling are supplied directly from the engine diffuser case without passing through the bleed valve.

The bleed valves are electrically signalled and pneumatically actuated. They also act as pressure regulators to maintain a manifold pressure no greater than 40 psi. The bleed valves will open any time the solenoid is electrically energized, the bleed air pressure is higher on the engine side than the manifold side, and there is a demand for air. They serve to act as check valves as they will close if manifold pressure exceeds engine bleed pressure. Removal of electrical power will cause the valves to close under any condition.

Each bleed valve is equipped with a position switch which turns on a "valve closed" light on the overhead panel when the valve is closed. The position switch is armed any time the essential DC bus is powered and is independent of the bleed valve control switch.

The high duct pressure red light located above the bleed valve closed lights indicates that the pressure in the manifold is in excess of 55 psi. This normally indicates that one bleed valve is not regulating at the proper pressure. The other three bleed valve closed lights will be on and the closed light for the malfunctioning valve will be out.

Placing the control switch for the bad valve to CLOSE should cause it to close and the remaining valves to open. The red light should go out as duct pressure returns to normal.

The bleed valves are also a part of the isolation system which permits isolating bleed air from certain sections of the ducting so bleed valves are also affected by the two wing isolation switches. The wing isolation switches must be in AUTO or MAN OPEN for the bleed valves to be opened.

The bleed valves are powered by 28 volts DC with the Emergency DC bus supplying the left side and the Essential DC bus supplying the right side.

The fuselage isolation valves are also electrically signalled, pneumatically actuated butterfly valves. They will open any time the solenoid is energized and air pressure is available to either side of the valve. They are controlled by both the wing isolation switches and the fuselage isolation switch, with the fuselage switch having priority.

The fuselage isolation valves are located just inboard of the fuselage skin so all bleed air can be isolated from the fuselage area if a leak should develop in the ducting within the fuselage. There are no lights to indicate the position of the fuselage isolation valves so other indications must be used to verify their position.

C. EXCESS HEAT AND ISOLATION

The excess heat and isolation system is designed to protect aircraft structure against overheat damage if a leak should occur in the bleed air ducting. The continuous loop overheat detectors are mounted close to the ducting and monitors the areas within the wings, into each engine pylon and along the rain clear duct up to the base of the windshields. A separate loop is provided for each wing and one for the fuselage area.

The system has three isolation switches, three red indicator lights and a test switch located on the overhead panel. All switches are normally carried in AUTO which permits automatic isolation of a wing area or fuselage area if an overheat occurs. OFF position of each switch removes power from the valves, causing them to close and isolate the area. This is normally referred to as Manual Isolation. MAN OPEN position of the switches bypasses the automatic function and causes the valves to remain open, regardless of the temperature of the loop detector.

An overheated loop detector causes the associated valves to close and the excess heat light to come on. The loop will cool when the valves are closed but the light will remain on and the valves will remain closed until the isolation switch is moved from AUTO to OFF. The valves will reopen when the switch is placed back to AUTO but would be reclosed if the leak still existed.

An automatic isolation cannot occur while the isolation switches are in the MAN OPEN but a warning would still be provided by the excess heat light on the isolation panel.

Any isolation switch in OFF prevents starting engines 1 and 2 with start cart air since any isolation switch in OFF closes at least one isolation valve.

EXCESS HEAT AND ISOLATION (CONT'D.)

The test switch on the excess heat and isolation panel provides a means for testing the operation of the system. The test circuit is deactivated while in flight by a ground safety relay since testing causes all bleed and isolation valves to close and would cause the loss of all pressurizing air sources until the isolation switches were cycled to OFF and back to AUTO or MAN OPEN.

When the switch is placed to TEST, a test relay is energized. This grounds all continuous loops to check their continuity and causes the controller to close all bleed and isolation valves. The red excess heat lights also come on. Failure of any area to isolate or any excess heat light to come on prevents the aircraft from being dispatched until the problem has been corrected. The excess heat and isolation is normally tested immediately after all engines are started. The proper procedure for testing the system can be found in section 02.19 of this handbook.

ENGINE ANTI-ICING

Engine bleed air is used to provide anti-icing heat to the leading edge of the cowling and the front section of the engine. Engine anti-icing is used on the ground as well as in flight. Icing of the compressor inlet is possible on the ground when the temperature is above freezing if visible moisture is present because of the temperature drop at this point when the engine is operated at high power.

The leading edge of the cowling, commonly called the nose cowl, is anti-iced with bleed air from the manifold. The EPR probe is also anti-iced with air from the manifold. EPR probe anti-icing is continuous any time the manifold is pressurized as there is no shutoff valve in the line. The engine inlet is anti-iced with air from the diffuser section of the respective engine.

All engine anti-ice valves are electrically signalled, pneumatically actuated butterfly valves. The nose cowl valves are powered by DC voltage and the engine inlet valves are powered by AC voltage.

Each engine inlet system also contains a temperature sensitive valve in series with the control valve and is known as the CDT (compressor discharge temperature) valve. It is open at low temperatures and modulates toward closed as the temperature of the air increases at the higher engine thrust setting. It never fully closes but allows sufficient air to pass for satisfactory anti-icing without danger of overheating the magnesium front frame of the engine.

Each engine anti-ice system is equipped with a Malfunct. light located above the control switch on the overhead panel. The light will indicate malfunctions of both anti-ice valves.

The following malfunctions are indicated by the Malfunct. light:

Nose cowl valve failed to open.

Engine inlet valve failed to open.

Engine inlet valve failed to close.

The Malfunct. light will normally be on with the engine at idle and engine anti-ice on because the operation of the inlet valve is monitored by a pressure switch sensing pressure between the inlet valve and the C. D. T. valve. Without the added restriction of the C. D. T. valve, air pressure at the pressure switch is low causing the light to remain on until the engine is accelerated. Proper operation of the C. D. T. valve is indicated if the light goes out before engine RPM reaches 75%. Refer to the 01 section of this chapter for operating instructions if the inlet valve remains open with the anti-ice switch off and ram air temperature is above 15° C.

Oil lines to and from the front bearing of the engine pass through the number five strut of the front frame. Anti-icing bleed air also passes through this area and causes heating of the engine oil any time engine anti-icing is on. This temperature rise will occur at a rate of approximately one degree per minute with a maximum rise of about ten degrees. This temperature rise can be used as an additional indication of anti-icing air reaching the front frame.

The engine inlet valve and the Malfunct. light are both armed by a relay for each engine. If the relay fails to operate when anti-icing is turned on, the inlet valve will not open and the Malfunct. light will be inoperative. Proper operation of the relay is indicated by a flash of the Malfunct. light as engine anti-icing is turned on. If the light fails to come on momentarily when the anti-ice switch is turned on, the front frame will get no heat but the Malfunct. light will not indicate the problem.

A blue Anti-Ice On light is located on the wing anti-ice panel and will be illuminated when any engine anti-ice switch or the wing anti-ice switch is on. It indicates switch position only.

E. EPR PROBE ANTI-ICING

Anti-icing air is available to the EPR probe any time the manifold is pressurized. Airflow is continuous since there is no shutoff valve in the line. If the aircraft is operated in icing conditions with a wing isolated, the EPR probe could ice over and cause a rapid and erroneous rise in EPR indication on the affected engines.

F. WING ANTI-ICING

Wing leading edges are anti-iced by hot bleed air that is directed through channels between the two layers of the leading edge skin. Air is supplied through pressure regulating valves from the wing manifold. These valves are electrically signalled and pneumatically actuated. The six valves are controlled by a single wing anti-ice switch. The blue Anti-Ice On light illuminates any time this switch is on.

Each wing anti-ice valve contains a position switch to monitor valve position. The lights will be on if the wing anti-ice switch is on and the valves are closed. No indication will be given if a valve remains open when the switch is turned off. The lights are placarded to correspond to the position of the valves they are monitoring.

A temperature monitoring system is provided to further aid in detecting system malfunctions. Six sensors imbedded in the leading edge of the wing perform three functions. They will provide a temperature indication on a temperature gauge on the overhead panel, illuminate an excess heat light on the same panel and cycle the wing anti-ice to protect the leading edge skin against overheat damage.

F. **WING ANTI-ICING** (CONT'D.)

Failure of a wing anti-ice valve to modulate properly with the switch on or close when the switch is turned off will be indicated by a high temperature on the gauge, red excess heat light or both. Air flow to that wing can be stopped by manually isolating the wing.

Wing anti-icing can be used in flight any time airframe icing is evident or anticipated. It should not be used on the ground except for the purpose of testing the system.

G. **LEADING EDGE AND DUCT SPACE TEMPERATURE**

A temperature gauge, an eighteen position selector and an excess heat light are located on the overhead panel. The selector permits connecting the gauge to each of the eighteen sensors. Five sensors are located along the bleed air duct in each wing, two along the rain clear duct and six in the leading edge skin. Positions one through six of the selector switch are connected to the skin patch sensors in the leading edge of the wings. Positions seven through eleven and fourteen through eighteen are connected to the duct space sensors along the bleed air manifold. Positions twelve and thirteen are connected to the duct space sensors along the rain clear duct. There are no duct space sensors in the pylons.

Duct space sensors, when overheated, turn on the excess heat light and provide a temperature indication on the gauge if the selector is positioned to that sensor position. The light is always in the circuit and is independent of the selector switch.

The skin patch sensors in the leading edge of the wings have an additional function of cycling the wing anti-ice valves closed to prevent damage to the skin by overheating.

H. **WINDSHIELD AND WINDOW ANTI-FOG AND ANTI-ICE**

The three forward panels are normally referred to as windshields and the four side panels are windows. All panels are constructed of three layers of glass and two layers of vinyl. The windshields have two layers of conductive coating to provide both anti-fog and anti-ice capabilities. The side windows have a single layer of conductive coating and provide anti-fogging only.

The conductive coating for the anti-fog heat is located between the center layer of glass and the inner layer of vinyl. The anti-ice coating in the windshields is located between the outer layer of glass and the outer layer of vinyl. Each coating has an imbedded sensor that signals the controller to maintain the desired temperature. Sliding windows have disconnect plugs that open the electrical circuits to the windows when the windows are opened.

A separate switch is provided for each of the three windshields. These switches are three position with ANTI-ICE, OFF and ANTI-FOG positions. This permits only one type of heat to be applied at one time. Two switches control the heat to the four windows. One switch controls the power to the sliding windows and the other controls the power to the aft windows.

When the RAIN CLEAR switch is turned on, heat is automatically removed from the captain's and first officer's windshields. Electric heat remains on the center windshield.

Electrical power can be removed from the sliding and aft windows by pulling circuit breakers on "B" circuit breaker panel if a power relay should stick closed. Current limiters must be removed from the load busses beneath the engineer's desk to remove power from the windshields if their power relays should stick.

I. **RAIN CLEAR**

Rain clear provides improved visibility by discharging a layer of hot air across the windshield at high velocity thereby preventing the rain from reaching the surface. Rain clear air is supplied from the bleed air manifold. The rain clear valve is an electrically signalled, pneumatically actuated butterfly valve. A switch on the valve turns on the Rain Clear light on the overhead panel when the valve is open. The light is always armed and its operation is not dependent upon rain clear switch position.

Two small hinged ramps located just behind the nozzles at the base of the windshield raise to deflect the hot air off the glass to protect the windshields against overheat damage when the engines are operating at high thrust settings. The ramps are raised by bleed air pressure. The ramps will also raise if the windshield becomes overheated when bleed air pressure is less than normally required to raise the ramps. A temperature sensor imbedded in one vinyl layer of the windshield causes a valve to be energized in the ramp actuator so that the ramp is raised at a lower engine thrust setting. This condition normally occurs during long taxi periods. The ramps will retract when the sensor cools. Each windshield contains a sensor for ramp control but only the one in the captain's panel is used. If it should fail, maintenance personnel can connect the sensor in the first officer's panel into the circuit.

Overheating of the windshield during normal operation is prevented by an overheat circuit containing a temperature sensor mounted against the glass near the base of the windshield and an overheat switch in the rain clear duct.

The duct switch and the relay controlled by the sensor are in parallel so both must open simultaneously to cause the rain clear valve to close. The valve will reopen when either set of contacts close. The valve can be forced to stay open by pulling the RAIN CLEAR OVERHEAT CONTROL circuit breaker on "B" circuit breaker panel. The circuit breaker can be pulled any time the valve cycles closed and rain clear air is needed but should be reset as soon as possible to restore maximum protection to the windshield.

J. **RAIN REPELLENT**

Rain repellent is a chemically compounded material that, when spread over the surface of the windshield, causes the water to form into beads and be carried away by the airstream. The system normally provides excellent visibility in heavy rainfall.

The repellent is a liquid carried in a pressurized container mounted on the right aft bulkhead of the cockpit. A reservoir sight gauge containing a red edged float is mounted directly below the container to provide a visual indication when the repellent supply in the container is depleted. The float is normally hid at the top of the reservoir and is visible when the level of the liquid drops below the top of the reservoir. Approximately twenty applications of repellent are still available for use when the float becomes visible. Maintenance should be advised to change the container as soon as possible after the float becomes visible.

RAIN REPELLENT (CONT'D.)

Rain repellent works best when rainfall is heavy but has been used very successfully in light to moderate rain. It should not be used in misty conditions as sufficient moisture may not be available to properly spread the material over the glass and a cloudy condition of the surface may result.

Two push button switches for control of the system are located on the overhead panel. Electrical power is from the essential DC bus. Pressing the switch energizes a solenoid valve to discharge the repellent to the windshield. The solenoid is equipped with a timing device which permits it to remain open only three tenths of a second so a measured amount of repellent is applied each time the switch is pressed. The switch must be released before a second application can be applied.

Rain repellent should be applied to one windshield at a time. A second application may be applied if necessary to maintain good visibility. Care should be exercized to prevent discharging the repellent on a dry windshield as visibility would be severely restricted until proper cleaning of the windshield was possible.

. **PITOT - STATIC AND SCAT HEAT**

The pitot heads, static ports, and the SCAT lift transducer are all heated electrically to prevent ice formation. Heating power to the left pitot head and the SCAT lift transducer is controlled by the pilot's switch and heating power to the right pitot head and both sets of static ports is controlled by the first officer's switch.

Power is supplied directly to the units through the switches. Blue indicator lights, turned on by current sensing relays, provide indication of proper operation of the heater circuits. A failure of the current sensing relay can cause the light to remain out although current may still be flowing to the heating element.

The static port heating blankets contain two heating elements. One is a fifty watt element which receives power continuously when the switch is on. The other is a three hundred watt element in series with a thermal switch which will open the circuit when the area is heated to the desired operating temperature. This causes cycling of the lights.

Power to the SCAT lift transducer is also controlled by an air-ground relay which switches the power from 115 V. AC while in flight to 28 V. AC during ground operation. Current flow during ground operation is not sufficient to energize the current relay and light the indicator light. The SCAT light should come on as the aircraft becomes airborne.

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VERTICAL GYRO MALFUNCTIONS

Trouble in the vertical gyro systems will affect operation of the Autopilot system, Weather Radar Antenna, Flight Director system and Horizon Indicators. In most cases, malfunction of a vertical gyro system will be indicated by appearance of the "Gyro" warning flag on the associated horizon director indicator.

The most rapid method of isolating trouble in the vertical gyro systems is to perform a test of the system and observe the results on the horizon director indicators. Since the captain's indicator can be slaved to the first officer's indicator, it is possible to compare both indicators operating from one vertical gyro.

IF NO. 1 GYRO IS MALFUNCTIONING:

1. Place HOR GYRO switch to No. 2 position.
2. Do not use the first officer's command bar.

IF THE NO. 2 GYRO IS MALFUNCTIONING:

1. Do not engage the autopilot. (DAMPER may be used).
2. Place the captain's FLT DIR selector switch to the No. 2 position.
3. Place radar stabilization switch OFF.

GYRO FLAG IN HDI

1. If in captain's indicator, place HOR GYRO switch to the 2 position.
2. If flag still showing or if in the first officer's indicator, check VERT GYRO and NAV INST AMP circuit breakers.
3. Place AC power switch to standby to check power transfer.

ABNORMAL HORIZON INDICATION

1. Check for GYRO OFF flag. If showing, make checks shown for GYRO OFF flag.
2. To check captain's indicator, place HOR GYRO selector switch to 2 position and move pitch trim knob on the first officer's HDI. Note that captain's HDI agrees with the position of the first officer's HDI. (Captain's horizon may be retrimmed if necessary.)

COMPASS FAIL FLAG IN FPI

1. If in captain's indicator, place COMPASS switch to No. 2 position.
2. If flag still showing or if in first officer's indicator, check REMOTE COMPASS and NAV INST AMP circuit breakers.
3. Attempt to slew compass card with the set knob on the compass controller. If compass card moves, flag is a false warning.
4. If both FPI flags are showing, check for MAIN transformer warning light.
5. If MAIN light is on, place AC selector to STANDBY and check transfer of FPI power. Switching to STANDBY will not restore power to the compass system.
6. If unable to restore FPI compass card, pull COURSE knob out and set the card manually to desired heading.

COMPASS DEVIATION LIGHTS ON

1. Crosscheck all compass cards, FPI and opposite RMI should agree.
2. Lights should be on when approximately 8 degrees difference exists between RMI cards.
3. If a compass system appears to be in error (both FPI and RMI cards disagree by the same amount), check sync meters in both compass controllers for normal operation. Meters should oscillate with equal deflection each side of center.
4. Re-sync compass if abnormal sync meter indication is noted.
5. If light remains on or system will not sync, check REMOTE COMPASS circuit breaker.
6. If captain's FPI is in error, switch COMPASS SEL to No. 2 position.

COMPUTER FLAG IN HDI

FLIGHT DIRECTOR OPERATION

1. Check mode selector, must be in HDG, LOC/VOR or GS position.
2. Check for GYRO OFF flag in first officer's HDI, if showing make checks shown under GYRO FLAG.
3. Place Flight Director selector switch to No. 2 position.

SCAT OPERATION

1. Check mode selector in SCAT mode.
2. Check for flag in slow fast indicator.
3. Check SCAT circuit breaker

FAILURE OF AUTOPILOT TO ENGAGE

1. Check DAMPER position. If DAMPER will engage but AUTOPILOT will not engage, check:
   a. That autopilot turn control knob is centered.
   b. Mode selector is in MAN position.
   c. Gyro flag in first officer's HDI.
2. If DAMPER will not engage, check:
   a. That No. 3 bus is powered.
   b. Autopilot disconnect buttons.
   c. AUTOPILOT circuit breaker.
   d. AUTOPILOT current limiters at the No. 3 bus.

ALL ESSENTIAL RADIO EQUIPMENT INOPERATIVE

1. Check that PILOT'S ESSENTIAL AC bus and the EMER DC bus are powered.
2. Place both ESS OVERRIDE circuit breakers ON.
3. If still inoperative, check radio current limiter at EMER bus.

ALL ESSENTIAL NAVIGATIONAL RADIO EQUIPMENT INOPERATIVE (NO. 1 VHF NORMAL)

1. Check that PILOT'S ESSENTIAL bus is powered.
2. Place AC ESS OVERRIDE circuit breaker ON.
3. If still inoperative, check current limiter at PILOT'S ESS bus.

L OR SEVERAL NORMAL RADIO UNITS INOPERATIVE

1. Check that the No. 3 AC and the ESS DC busses are powered.
2. Check RADIO current limiters at the ESS DC bus.
3. Check RADIO current limiters at the No. 3 bus.

OTH TRANSPONDER UNITS INOPERATIVE

1. Check control panel switches for proper position.
2. Pull circuit breakers for the transponder unit on standby.
3. Pull both DME circuit breakers.

LEC. EQUIP. COOLING LOW AIR FLOW LIGHT ON

1. Place switch to FAN ON position.
2. If light remains on:

   a. Check ELEC COMP FAN CONT circuit breaker.
   b. Check ELEC COMP current limiters at No. 3 bus.

   NOTE

   If light cycles on and off when the fan is running, one current limiter may be blown causing the fan motor to cycle on overheat switches.

OC OR GS WARNING FLAG IN FPI

1. Reselect frequency to check receiver channeling.
2. If in captain's indicator place VOR DEV selector switch to No. 2 position, set desired frequency with the No. 2 control and the proper course in the first officer's FPI. (Both FPIs should always be set to the same course when switched. Loss of the first officer's TO-FROM indication will occur.)
3. Check circuit breakers for the appropriate receiver.
4. Do not rely on indication when a flag is showing.

ME MALFUNCTIONS

ailure of the DME to "Track" might be attributed to:

1. Improper frequency selection.
2. Lack of a DME station at that facility.
3. Station selected is beyond DME range.
4. Station selected is not operating.
5. Override-Normal switch in normal position.
   Before the DME equipment is assumed to be malfunctioning, check operation on more than one station.

he DME and the ATC Transponder "share time" in that when one sending a pulse the other is suppressed. Malfunction of this ynchronization" function could result in the ATC radar beacon eing reported as malfunctioning and the DME failing to "track". this case, pull DME circuit breakers in an attempt to restore TC transponder operation.

AIN 26V AC TRANSFORMER LIGHT. . ON (NO. 3 BUS POWERED)

1. Place selector switch to standby position.
2. Check for compass fail flags on both FPI instruments.

STANDBY 26V AC TRANSFORMER LIGHT . . ON (PILOT'S ESSENTIAL BUS POWERED)

1. Check for operation of first officer's RMI. (Compass Deviation lights should come on when RMI cards differ by approximately 8 degrees.)

   a. If inoperative, check current limiter on Pilot's Essential bus placarded STANDBY INST TRANS.

* * *

A. AUTO PILOT CONTROLLER

PITCH WHEEL

Operable in HDG, MAN, LOC/VOR, and G.S. Auto (prior to glide slope engagement for pitch changes. Pitch wheel is ineffective:

1. When auto pilot switch is in Damper position.
2. With ALT. Hold ON.
3. When G.S. MAN mode is selected.

TURN CONTROLLER

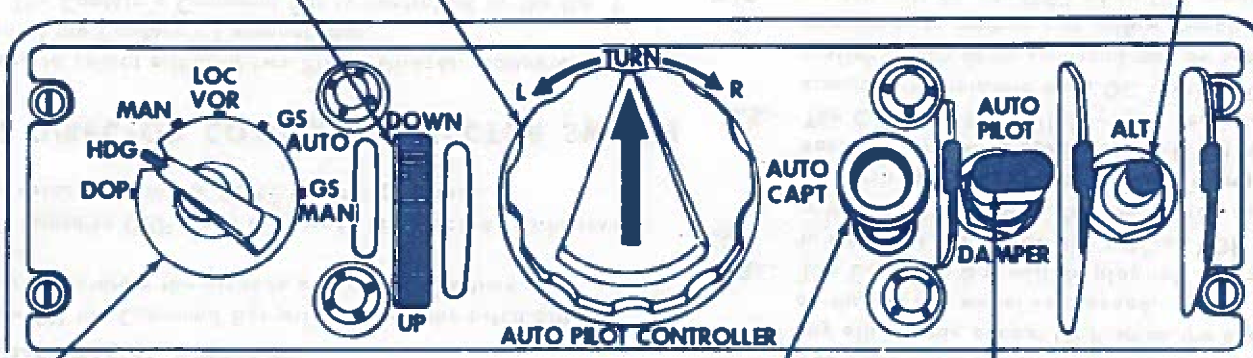
Intended for use when in the MAN mode. If turn controller operated while in some mode other than MAN, the mode selector automatically is released and springs back to the MAN mode, and the aircraft turns. Turn controller will command a maximum bank of 35° in the MAN mode. Not operable in damper mode.

ALTITUDE HOLD SWITCH

Held in ON position by electric holding coil. Automatically returns to OFF position when:

1. Autopilot disengaged.
2. Entering centerline of glide slope when in G.S. AUTO mode.
3. Mode selector is placed to G.S. MAN.

Does not operate when switch is in DAMPER position.



MODE SELECTOR

Normally held by spring loading in the MAN position. Held in all other positions by electric holding coil action. Automatically returns to MAN position when:

1. Auto pilot disengaged.
2. Turn controller rotated out of center detent.
3. Changing frequency while in either G.S. mode.
4. VOR receiver loses D.C. power when in either G.S. mode.
5. With auto capture button depressed, and in heading mode, when aircraft has started capturing the localizer or VOR course.

AUTO CAPTURE (YELLOW) BUTTON

Depress only in HDG or MAN mode. This action arms the autopilot for an automatic VOR or LOC course capture after the "LOC" needle becomes alive. Prior to capture the aircraft can be maneuvered for heading changes.

Auto Capture on VOR will begin when "LOC" needle indicates 3/4 of a dot from center. Auto Capture on localizer begins when "LOC". needle indicates approximately 2 dots from center.

Auto Capture button will be released by selection of LOC/VOR, G.S. AUTO, or G.S. MAN modes.

POWER SOURCE

C12 - AUTO PILOT

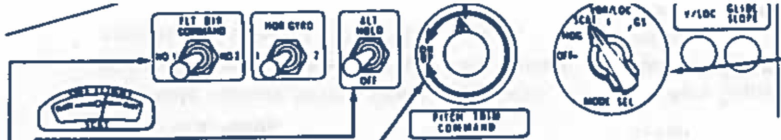
ENGAGE SWITCH

Held in DAMPER or AUTO PILOT position by electric holding coil action.

AUTO PILOT - Engages rudder, aileron, and elecator servos.

OFF - If positioned off by hand will cause auto pilot warning light to flash. Normally positioned off by pressing auto pilot disconnect button on either Pilot's control wheel.

DAMPER - Engages only the rudder servo for damping out "Dutch Roll".



MODE SELECTOR

Used to select the operational mode of the Flight Director Command Bar.

OFF - Flight Director not being used and the Command Bar out of view. Computer flag appears.

HDG - The Command Bar displays the roll commands necessary to turn toward and maintain the heading that is selected by the HDG set knob on the FPI and pitch commands to maintain attitude.

SCAT - On aircraft with SCAT equipment installed, the Command Bar will display a roll command to maintain a wings level condition. The Command Bar will also display a pitch command for a target pitch attitude.
The mode selector will return to the SCAT position from any other mode except OFF when the disconnect button on the control wheel is pressed.

VOR/LOC - The Command Bar will display roll commands necessary to intercept and follow the LOC or VOR course selected with the FPI COURSE knob and pitch commands to maintain attitude. During beam tracking, any correction necessary for wind conditions will automatically be made.

G.S. - The Command Bar will display a reduced amount of roll command to maintain the LOC course. On initial selection, a slight pitch down command may be seen followed by pitch commands to capture and follow the glide slope beam.

THE ALT HOLD - switch will drop to OFF when G.S. mode is selected.

C11 - NO. 1 FLIGHT DIR.
C5 - NO. 2 FLIGHT DIR.
C2 - SCAT PWR SOURCE.

PITCH TRIM COMMAND KNOB

Will trim the Command Bar in pitch so that any desired pitch attitude can be flown in HDG or VOR/LOC mode with the Command Bar centered.

The pitch command trim knob is not active when the ALT. HOLD switch in ON or the mode selector is in G.S. position.

The Captain's pitch trim command knob is inoperative when the FLT DIR COMMAND selector switch is in the No. 2 position.

ALTITUDE HOLD SWITCH

When ON the Command Bar will indicate the pitch attitude necessary to maintain the altitude existing at the time of engagement.

Will return to OFF when G.S. mode is selected or whenever the mode selector is in the SCAT or OFF positions.

FLIGHT DIRECTOR COMMAND SELECTOR SWITCH

Used to select either of two Flight Director Computers for operation of the Captain's Command Bar.

No. 1 - The Captain's Command Bar is controlled by the No. 1 computer and the No. 1 Flight Director controls on the Captains panel.

No. 2 - When in this position, the No. 2 computer will control both Command Bars. The Captain's CMPTR fail flag will monitor computer - 2 power. The Captain's disconnect button on the control wheel will not disconnect the No. 2 Flight Director.

C. COCKPIT VOICE RECORDER AND MARKER BEACON LIGHTS

COCKPIT VOICE RECORDER - MARKER BEACON LIGHTS

OPEN MICROPHONE

Monitors conversation in cockpit area if pilots essential AC bus powered and ESSENTIAL radio switch is ON.

TEST BUTTON

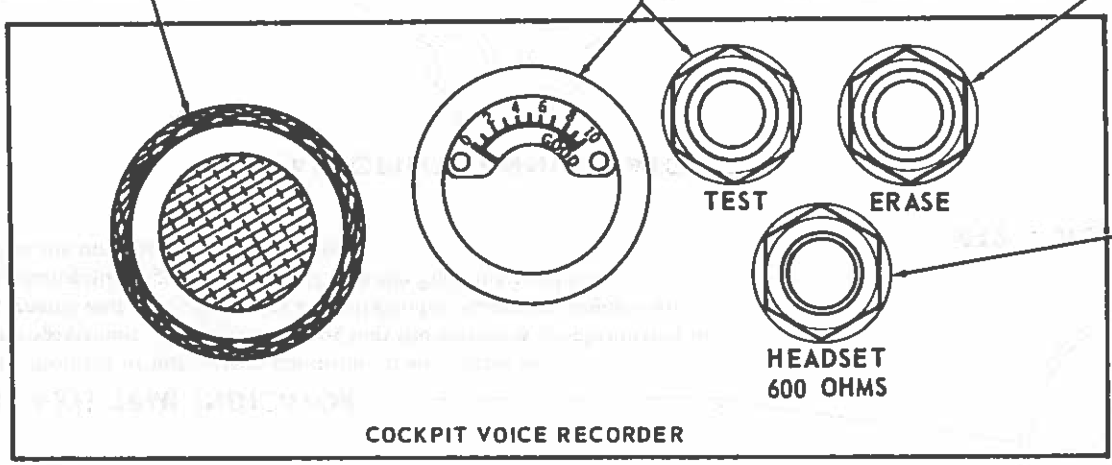
System is tested by depressing test button. If meter indicates in "green" area (8-10), all five recorder channels are operating normal.

ERASE BUTTON

The entire 30 minutes is erased by depressing ERASE button for approximately 2 seconds. Left MLG safety switch must be in ground position; parking brake set; ESSENTIAL radio switch ON, and pilots essential AC bus powered.

HEADSET JACK

System performance can be monitored which was recorded approximately one second earlier.



C5 - VOICE RECORDER
(Pilots Essential AC)

MARKER BEACON LIGHTS

White light-airway marker light. Also indicates passage over inner marker of ILS. (Steady Dots.)

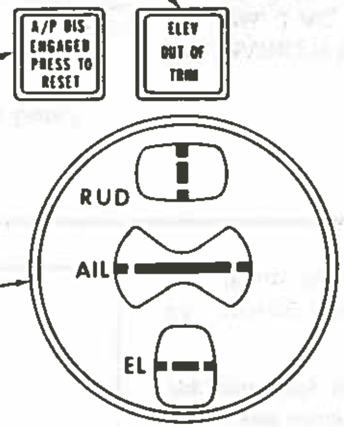
Blue light-indicates passage over outer marker of ILS. (Steady Dashes.)

Amber light-indicates passage over middle marker of ILS. (Alternate Dashes and Dots.)

Following removal of HI-LO switch, system sensitivity remains in low position, providing more precise marker identification.

C4 - MARKER BEACON
(No. 3 AC - Receiver)
(Ess DC - Lights)

D. AUTO PILOT TRIM INDICATOR



C12 - AUTOPILOT

ELEVATOR OUT OF TRIM LIGHT

That will alert the crew that some trim is required in pitch. The amount of trim will be indicated by displacement of the elevator trim indicator.

AUTOPILOT DISENGAGED LIGHT

Will give a flashing warning that the AUTOPILOT has disengaged by some means other than pressing either disengage button. The light can be extinguished by pressing either disengage button or the light. An unusual condition is a steady light indication. This is caused by failure of EMER. D. C. bus power to the warning light relay.

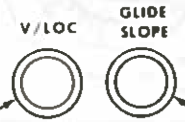
THREE (3) AXIS TRIM INDICATOR

A visual monitor of out-of-trim condition in all control axes.

Before engagement - It shows the Pilot that the system is synchronizing to aircraft movements and that conditions are suitable for Autopilot engagement.

During Autopilot engaged modes - It tells the Pilot the need for trim, as well as the direction of trim required.

AUTOPILOT ANNUNCIATORS



V/LOC ANNUNCIATOR

BLANK - Indicates blank when in HDG mode or in MAN mode (auto capture button not depressed).

ARM - Indicates ARM when in LOC VOR, G.S. AUTO, G.S. MAN or MAN (auto capture button depressed) modes, prior to localizer or course capture.

ON - Indicates ON when course is intercepted or localizer captured, while in LOC VOR, G.S. AUTO, G.S. MAN or MAN mode (auto capture button depressed).

GLIDE SLOPE ANNUNCIATOR

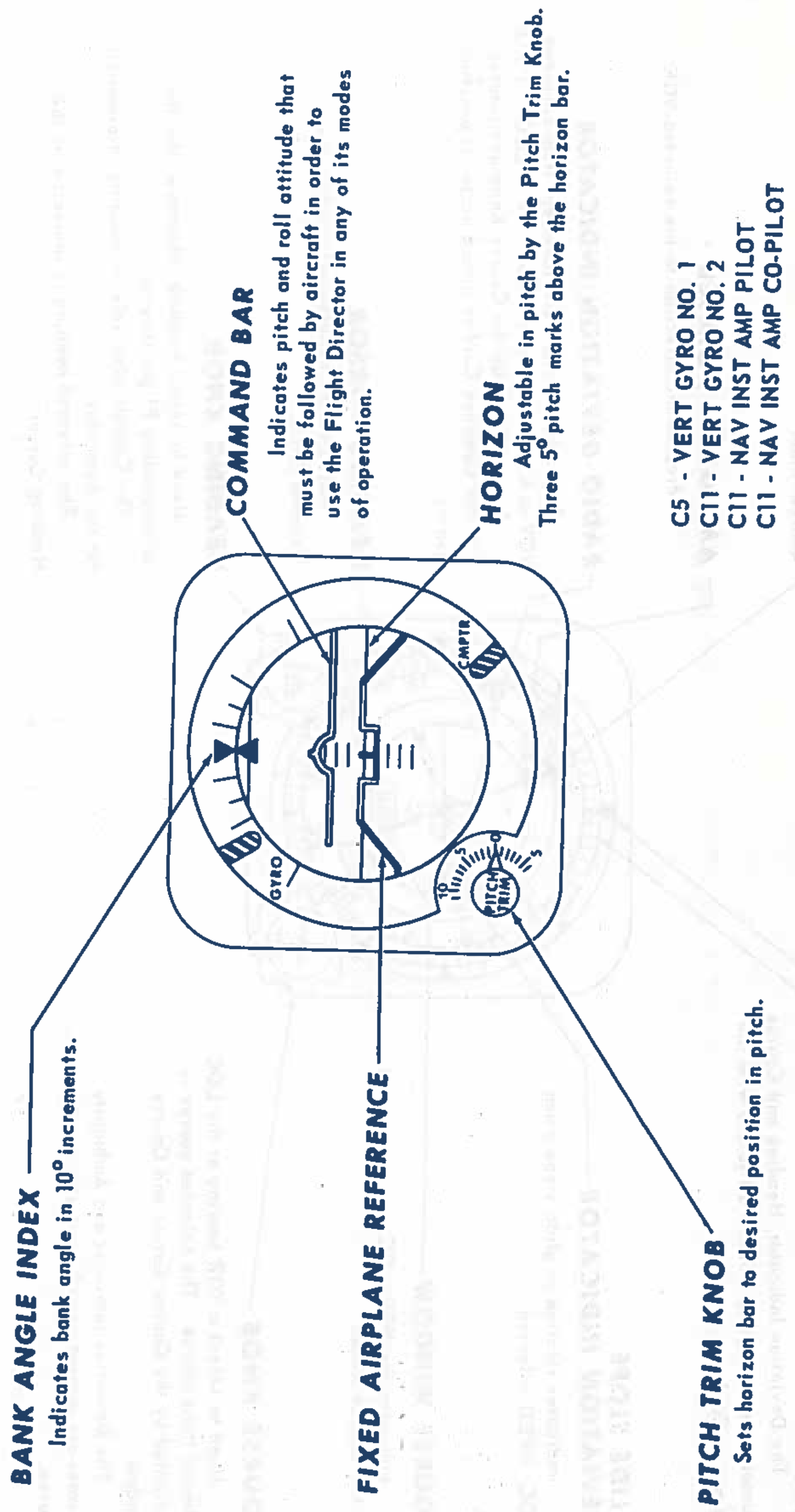
BLANK - Indicates blank when in HDG, or LOC/VOR modes, or MAN (auto capture button not depressed).

ARM - Indicates ARM prior to glide slope intercept while in G.S. AUTO, G.S. MAN or MAN (auto capture button depressed) modes.

ON - Indicates ON when glide slope is intercepted while in G.S. AUTO, G.S. MAN or MAN (auto capture button depressed).

NOTE: The V/LOC or G.S. annunciator will trip to ON if a ground transmitter failure occurs, and the annunciator was indicating ARM prior to the failure.

E. HORIZON DIRECTOR INDICATOR



(5103)

COMPASS CARD

Indicates the aircraft heading at the Lubber Line.

The Deviation Indicator, Heading and Course Cursors and Ambiguity Pointer all rotate with the Compass Card.

LUBBER LINE

Indicates aircraft magnetic heading.

COURSE CURSOR

Indicates the course selected by the Course Knob.

AMBIGUITY POINTER

Indicates the direction to the selected VOR.

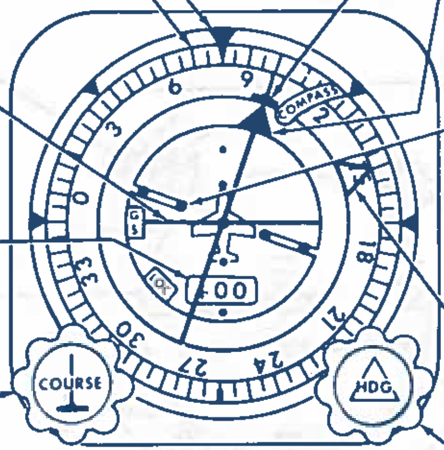
GLIDE SLOPE DEVIATION INDICATOR

Indicates relation to glide slope when LOC FREQ selected.

RADIO DEVIATION INDICATOR

Shows left or right displacement from selected VOR or LOC. One dot on VOR : 5°. LOC : 1 1/4°.

Is positioned by the Course Knob and rotates with the Compass Card to give a pictorial position display.



COURSE WINDOW

Indicates the VOR/LOC course selected by the Course Knob.

HEADING CURSOR

Indicates the heading selected by the Heading Knob.

COURSE KNOB

Used to select a VOR bearing or the LOC inbound front course. The selected course is indicated by the Course Cursor and Course Window.

The Deviation Indicator and Ambiguity Pointer are rotated and aligned with the selected course.

HEADING KNOB

Used to select heading information for the corresponding Flight Director.

The Captain also selects heading information for the Autopilot.

The selected heading is indicated by the Heading Cursor.

G. SWITCHES

FLIGHT DIRECTOR SWITCH

a. Normal operation-in the No. 1 position.
b. Placed in the No. 2 position if the Captain's flight director system fails.
c. When in the No. 2 position, the First Officer's mode selector, altitude hold and pitch trim command controls the Captain's command bar. The First Officer's disconnect button will also disconnect the Captain's flight director system in addition to his own.

COMPASS SELECTOR SWITCH

a. Normal operation-in the No. 1 position.
b. Placed in the No. 2 position if a COMPASS flag appears in the Captain's FPI.
c. When in the No. 2 position, the No. 2 compass system supplies heading information to the Captain's instruments, command bar and autopilot. The First Officer will lose heading information to his command bar and RMI card. The flight recorder will also lose heading information.

HORIZON SWITCH

a. Normal operation-in the No. 1 position.
b. Placed in the No. 2 position if a GYRO flag appears in the Captain's HDI.
c. When in the No. 2 position, the Captain's horizon is slaved to the First Officer's horizon. The First Officer's pitch trim knob if moved, will also move the Captain's horizon. The Captain can, however, re-adjust his horizon with his pitch trim knob.

DEVIATION VOR SELECTOR SWITCH

a. Normal operation-in the No. 1 position.
b. Placed in the No. 2 position if a G.S. or LOC flag appears in the Captain's FPI.
c. When in the No. 2 position, the No. 2 receivers supply radio information to the Captain's instruments, autopilot and command bar, in addition to the First Officer's instruments. For VOR operation, the Captain's OBI, both No. 1 pointers (RMI) and the First Officer's ambiguity indicator will fail. Wind integration to the autopilot and Captain's flight director system will be lost, until re-computed. The First Officer FPI course knob now controls radio information to the autopilot and Captain's flight director system.

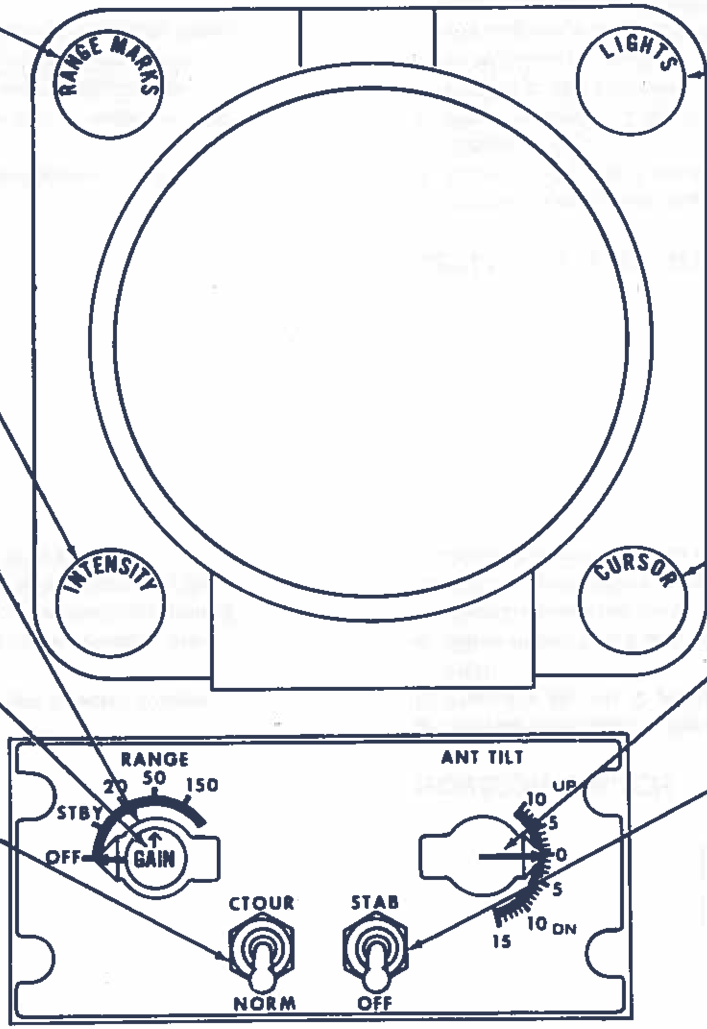
RANGE MARKS
Controls the brilliance of the 20 - 50 - 150 mile range marks. Can block out echoes if turned up too high.

INTENSITY KNOB
Controls brilliance of echos on the scope. Does not affect receiver sensitivity.

RANGE KNOB
OFF - Radar shut down.
STANDBY - Set is warmed up.
20 - 50 - 150 - Permits operation on any of the selected distances.

GAIN KNOB
Used to adjust the level of the received signal. Should be adjusted just below the "snow" level, on the 150 mile scale.

CONTOUR SWITCH
NORMAL - Used for general storm observation, ground mapping and tuning.
CONTOUR - Blacks out any reception over a preset intensity and is used to identify the heavy precipitation areas of a storm.



LIGHT KNOB
Adjusts brightness of screen illumination edge lights.

CURSOR KNOB
Rotates compass rose.

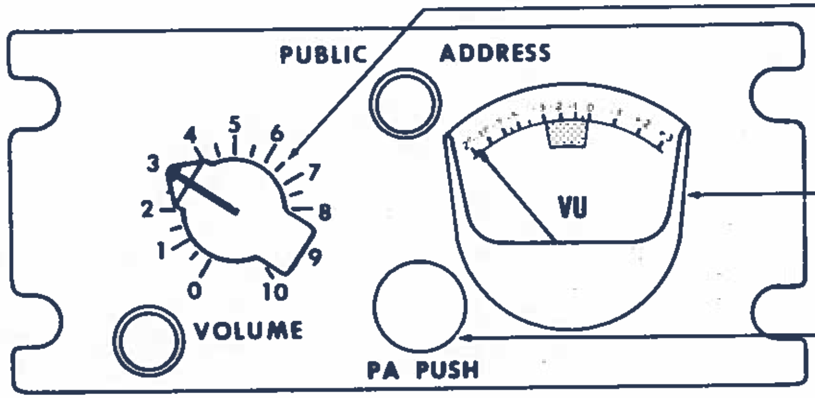
ANTENNA TILT KNOB
Adjusts antenna tilt angle with STAB either on or off.

STABILIZATION SWITCH
Feeds pitch and roll signals from the vertical gyro No. 2 to the weather radar antenna.

OFF - disconnects weather radar antenna from vertical gyro.

C5 - WX RADAR

I. P.A. CONTROLS



CONTROLS AUDIO

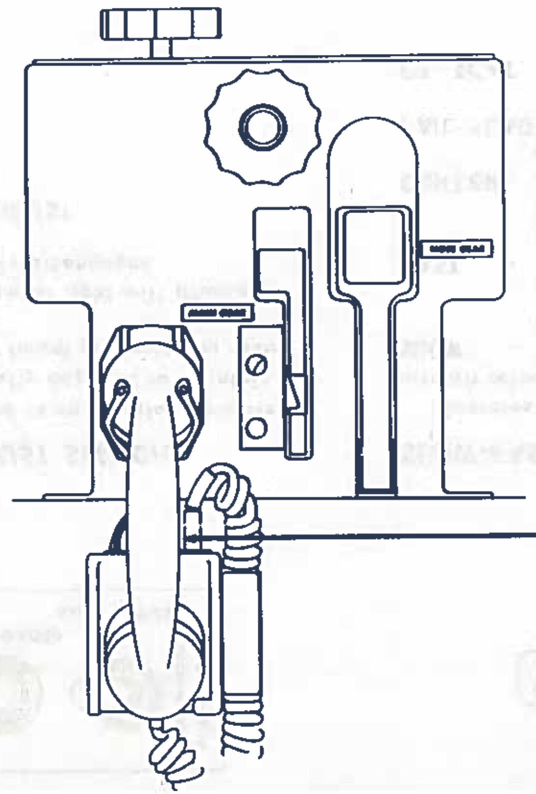
Output level of individual P.A. handset microphone. Volume normally adjusted to give peak readings to half scale on (VU) meter. Average position of volume control on 5.

VOLUME UNITS

(VU) meter indicates volume level of audio being fed thru handset microphone to P.A. amplifier.

PUSH BUTTON

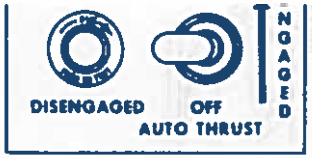
With integral amber light. A momentary push operates a hold in relay that disconnects the handset from interphone system and connects it to the P.A. system. Amber light extinguished when handset returned to cradle.
C1 - P.A. AMPL.

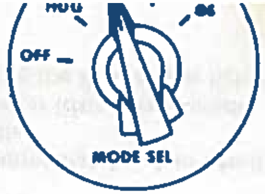


INTERPHONE SYSTEM AND/OR P.A. SYSTEM TELEPHONE HANDSET

INTERPHONE - Operable immediately when lifted from cradle.

P.A. - Operable after lifting from cradle and pushing the P.A. amber lighted button.





AUTO THRUST SWITCH

When turned to on position, throttles are automatically adjusted to maintain desired speed target presented on slow - fast indicator.

Flashing amber light will illuminate if auto thrust is disengaged.

C3 - AUTO THRUST.

SLOW-FAST INDICATOR

Operates in accordance with basic aircraft reference speeds.

SLOW - The aircrafts speed is slower than the optimum for existing operating condition.

FAST - The aircraft speed is faster than the optimum for the existing condition.

CENTER - Aircraft speed is satisfied for existing condition.

FAIL FLAG - Will appear if SCAT system inoperative.

C2 - SCAT.

SCAT MODE

In SCAT position, signals are received from SCAT computer. Indications are noted on command bar and slow - fast indicator.

C2 - SCAT.

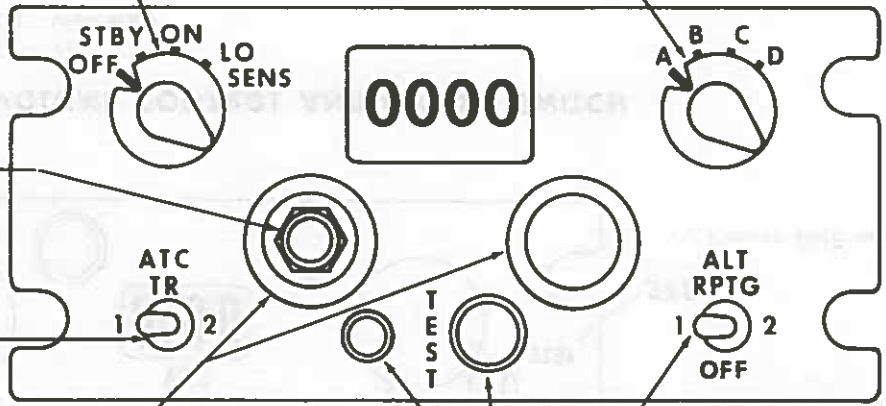
ATC TRANSPONDER

FUNCTION SELECTOR

OFF - Both transponders shutoff.
STBY - Both warmed up but not operating.
ON - Selected set is in operation.
LO SENS - Reduces output intensity of the operating set.

MODE SELECTOR

A - B - Identification and altitude.
C - Altitude only.
D - Future development.



IDENTIFICATION BUTTON

Momentarily press to increase the output signal for about 10 seconds.

ATC TRANSPONDER SWITCH

Selects the operating transponder. The other will be in standby.
C3 - ATC TRANSPONDER NO. 1.
C3 - ATC TRANSPONDER NO. 2.

3 POSITION ALT RPTG SWITCH

Selects desired KIFIS to either tansponder. With this switch in the OFF position the tans-ponder will continue to operate and only the altitude information will be deleted.

CODE SELECTION KNOBS

Selects the code numbers in the code window.

TEST SWITCH & LIGHT

When testing the light indicates a normal transponder.

VHF-VOR CONTROL HEAD

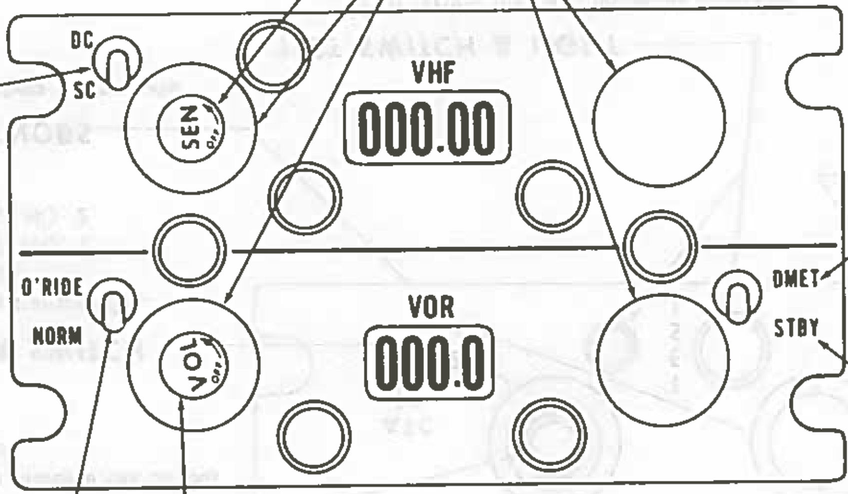
SENSITIVITY CONTROL AND ON-OFF SWITCH

C3 - NO. 1 VHF COMM.
C3 - NO. 2 VHF COMM.

FREQUENCY SELECTOR KNOBS

DC/SC SWITCH

Not used.



DMET

Places DME equipment into operation.

STBY

Places DME equipment on standby.

OVERRIDE SWITCH

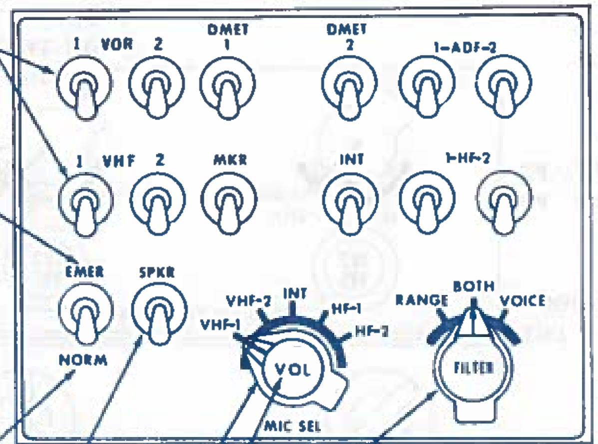
In override all DME stations will indicate slant range distance to the station, up to a distance of 200 n.m.

In the normal position those DME stations with frequences less than 112.0 mc will not indicate distances greater than 50 n.m., thus avoiding possible frequency interference.

VOLUME CONTROL AND ON-OFF SWITCH

C2 - VHF NAV
C2 - VHF NAV.

M. AUDIO SELECTOR BOX



HEADSET SWITCHES

Toggle switches for the selection of interphone or receiver audio.

EMER

Position to be used if internal transistor amplifier fails. In EMER position internal amplifier is by-passed and only one input can be heard, with greatest priority top left row and least priority right bottom row.

IN NORMAL

Position any number of headset switches can be up, and will be heard at the same time.

SWITCH

Enables Pilot or Co-Pilot to turn individual overhead loudspeaker on or off. Flight Engineer and Second Officer is not functional.

MICROPHONE SELECTOR

To connect microphone output into the interphone system or to communications radio system.

SERVICE INTERPHONE

To isolate cabin and cockpit from service interphone areas. Provided only at Flight Engineers station.

RANGE FILTER SWITCH

Enables the operator to connect a range filter into the output of any receiver audio.

HEADSET VOLUME CONTROL

Controls headset volume level for interphone, HF COMM and VHF COMM. Does not affect navigation receiver audio level.

N. ADF RECEIVER SELCAL

GAIN
Controls the sensitivity of receiver reception.

FREQUENCY SELECTORS
1 st KNOB - Controls first two numbers. A detented knob.
2nd KNOB - Controls third number. A detented knob.
3rd KNOB - Controls fourth number. A smooth tuning control.

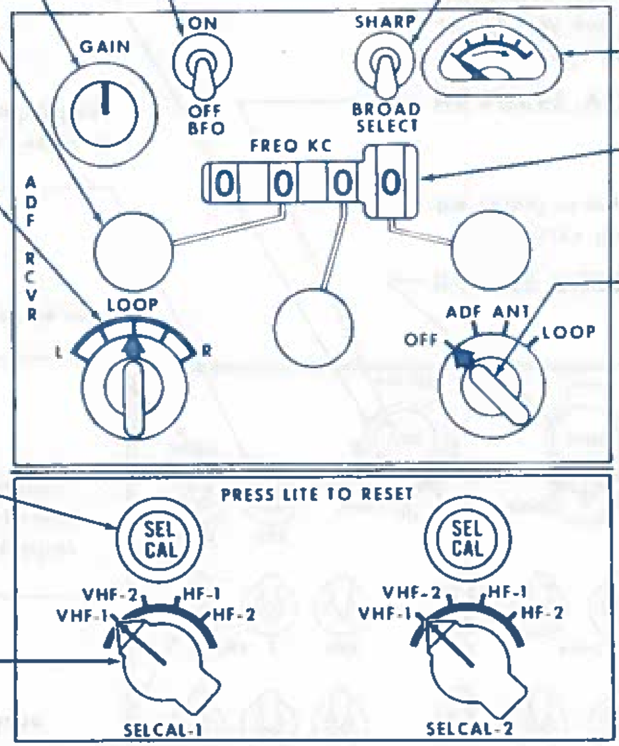
LOOP L-R SLEW SWITCH
Rotates the loop in either direction for manual ADF operation. Select LOOP mode and rotate loop to a signal null. The greater the switch displacement the faster the rotation. At the null position the RMI pointers will indicate the magnetic bearing to the station or a 180° ambiguity.

SELCAL LIGHT
Indicates decoder is activated by selected VHF. Press light to turn off and reset chime and light.

SELECTOR SWITCH
VHF #1 - Monitors VHF - 1 receiver for coded tone.
VHF #2 - Monitors VHF - 2 receiver for coded tone.

BFO
Adds a tone to help identify a non-directional radio station.

SELECT SHARP
Tuning position while tuning receiver for max. deflection on tuning meter. Return to BROAD position after tuning completed.



C2 - SELCAL NO. 1.
C2 - SELCAL NO. 2.

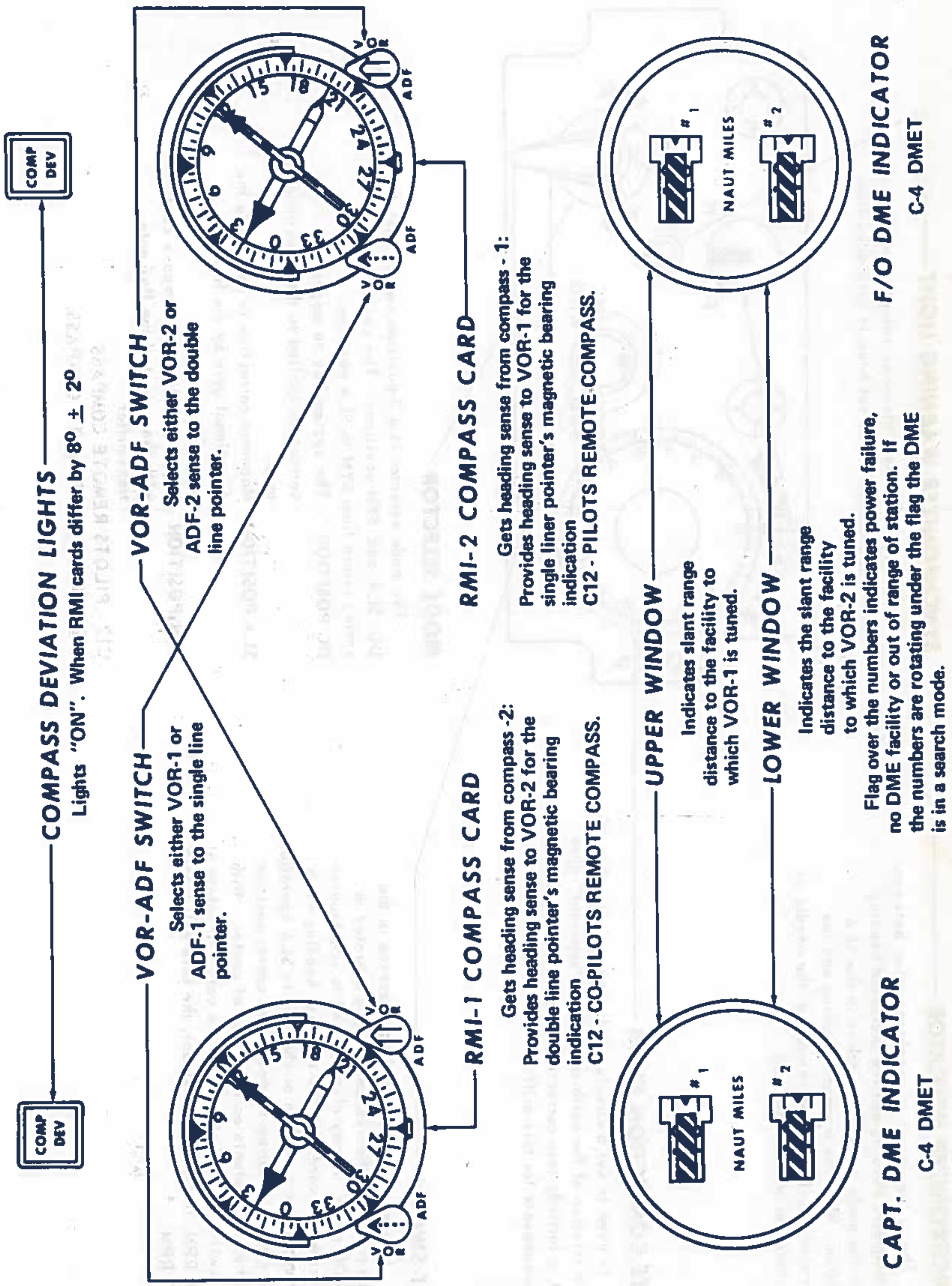
TUNING METER
Tune for maximum deflection

FREQUENCY TOLERANCES
± 3 kc below 900 kc.
± 5 kc above 900 kc.

MODE SELECTOR
OFF - Receiver shutoff.
ADF - Automatic Direction Finding. RMI pointers will indicate the magnetic bearing to the selected station.
ANT - Used for Range reception.
LOOP - Used in conjunction with the L - R switch for manual direction finding.

C4 - RADIO COMPASS NO. 1.
C4 - RADIO COMPASS NO. 2.

O. RMI-DME CONTROLS AND INDICATORS

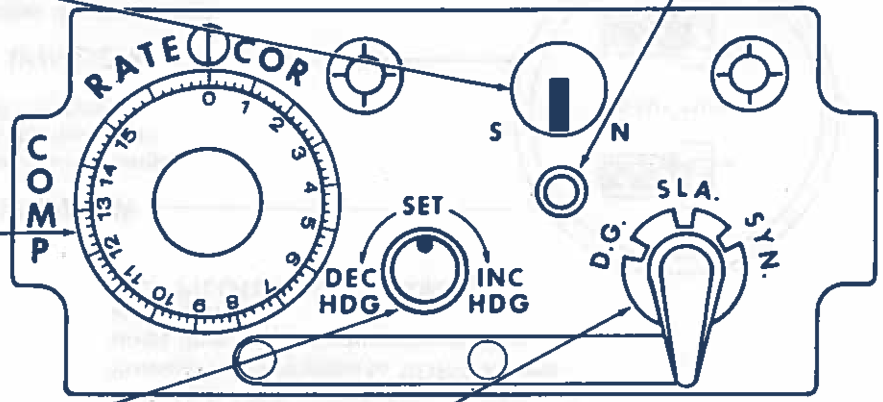


(4201)

Shows the degree of synchronization between the magnetic heading and the indicated heading when the mode selector switch is in the SLA position. When the magnetic heading and the indicated heading are synchronized, the needle of the indicator will be centered.

SYNCHRONIZER WARNING LIGHT

Indicates whenever the mode selector switch is in the SYN position or the set knob is displaced from center.



RATE CORRECTION KNOB

Is used to set a circular dial numbered from 0 to 15. Since rotation of the earth causes an "apparent" gyro drift, a latitude rate correction must be used in DG mode to compensate for this drift.

*

SET SWITCH

* Is used to set the heading reference in the indicator when the system is being operated in the DG mode. It may also be used to synchronize
* the compass card with the compass heading when the system is turned on or changed to SLA operation. The switch is spring-loaded to the center position and has two detents on each side of center. With the switch in the first detent, the card will rotate at 1/4 RPM, in the second detent, the card will rotate at 2 RPM.

MODE SELECTOR

The mode selector is a 3-position switch with DG, SLA and SYN positions. The switch has a spring return from SYN to SLA position.

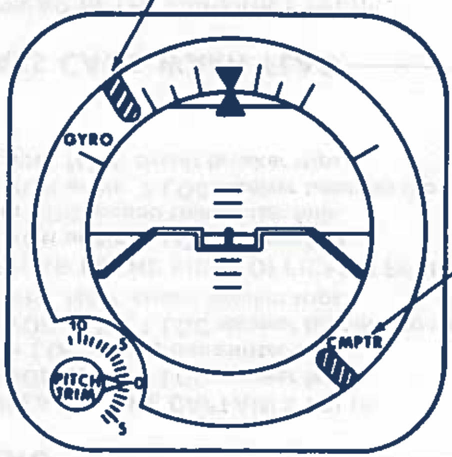
DG POSITION - The system has no magnetic correction applied to the directional gyro.

SLA POSITION - Magnetic correction is applied to the directional gyro by the flux-gate transmitter.

SYN POSITION - Is used to align the compass card with the output of the flux-gate transmitter.

C12 - PILOTS REMOTE COMPASS.
C12 - CO-PILOTS REMOTE COMPASS.

q. FLAGS



GYRO FLAG

WILL APPEAR IN THE CAPTAIN'S HDI IF:

a. Power loss occurs to the No. 1 vertical gyro.
b. Power loss occurs to the Captain's horizon amplifier.
c. No. 1 VERTICAL GYRO circuit breaker trips.
d. PILOT NAV INST AMPL circuit breaker trips.

WILL APPEAR IN THE FIRST OFFICER'S HDI IF:

a. Power loss occurs to the No. 2 vertical gyro.
b. Power loss occurs to the First Officer's horizon amplifier.
c. No. 2 VERTICAL GYRO circuit breaker trips.
d. COPILOT NAV INST AMPL circuit breaker trips.

COMPUTER FLAG

WILL APPEAR IN THE CAPTAIN'S HDI IF:

a. Captain's flight director mode selector is OFF.
b. In the SCAT mode and the SCAT system fails.
c. Captain's flight director computer amplifier power fails.
d. No. 2 vertical gyro power fails.

CAUTION

Captain's mode selector will trip to SCAT if power loss occurs to his flight director computer. A COMPUTER flag will not remain in his HDI if this occurs.

WILL APPEAR IN THE FIRST OFFICER'S HDI IF:

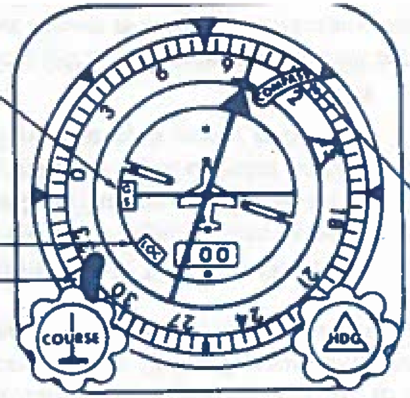
a. First Officer's flight director mode selector is OFF.
b. In the SCAT mode and the SCAT system fails.
c. First Officer's flight director computer amplifier power fails.
d. No. 1 vertical gyro power fails.

CAUTION

First Officer's mode selector will trip to SCAT if power loss occurs to his flight director computer. A COMPUTER flag will not remain in his HDI if this occurs.

WILL APPEAR IN THE CAPTAIN'S FPI IF:
a. No. 1 G.S. receiver fails.
b. G.S. ground transmitter fails.
c. No. 1 G.S. receiver signal becomes too weak.
d. No. 1 G.S. circuit breaker trips (Collins receiver).
e. No. 1 VOR D.C. circuit breaker trips (transistorized).

WILL APPEAR IN THE FIRST OFFICER'S FPI IF:
a. No. 2 G.S. receiver fails.
b. G.S. ground transmitter fails.
c. No. 2 G.S. receiver signal becomes too weak.
d. No. 2 G.S. circuit breaker trips (Collins receiver).
e. No. 2 VOR D.C. circuit breaker trips (transistorized);



LOC FLAG

WILL APPEAR IN THE CAPTAIN'S FPI IF:
a. No. 1 VOR or No. 1 LOC receiver fails.
* b. VOR or LOC ground transmitter fails.
c. No. 1 VOR or No. 1 LOC receiver becomes to weak.
d. No. 1 VHF NAV. circuit breaker trips.

WILL APPEAR IN THE FIRST OFFICER'S FPI IF:
* a. No. 2 VOR or No. 2 LOC receiver fails.
b. VOR or LOC ground transmitter fails.
c. No. 2 VOR or No. 2 LOC receiver becomes too weak.
d. No. 2 VHF NAV. circuit breaker trips.
*

COMPASS CAGE WARN FLAG

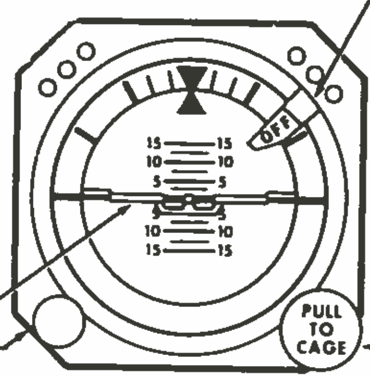
WILL APPEAR IN THE CAPTAIN'S FPI IF:
a. Captain's FPI course knob is pulled (card rotated manually).

WILL APPEAR IN THE FIRST OFFICER'S FPI IF:
a. First Officer's FPI course knob is pulled (card rotated manually).

COMPASS FLAG

WILL APPEAR IN THE CAPTAIN'S FPI IF:
a. Power loss occurs to the No. 1 compass system. (Pilots ESS A.C.)
b. Power loss occurs to the Captain's compass amplifier.
c. Main 26V transformer fails.
d. PILOT REMOTE COMPASS circuit breaker trips.
e. PILOT NAV. INST. AMPL. circuit breaker trips.
f. No. 1 COMPASS WARN circuit breaker trips (not on all aircraft).
g. Current limiter on No. 3 A.C. bus (Main transformer).
h. Current limiter on emerg. D.C. bus (Not on all aircraft).

WILL APPEAR IN THE FIRST OFFICER'S FPI IF:
a. Power loss occurs to the No. 2 compass system (No. 3 A.C.)
b. Power loss occurs to the First Officer's compass amplifier.
c. Main 26V transformer fails.
d. CO-PILOT REMOTE COMPASS circuit breaker trips.
e. CO-PILOT NAV. INST. AMPL. circuit breaker trips.
f. No. 2 COMPASS WARN circuit breaker trips (Not on all aircraft).
g. Current limiter on No. 3 A.C. bus (Main transformer).
h. Current limiter on No. 3 A.C. bus (Turn and Bank).

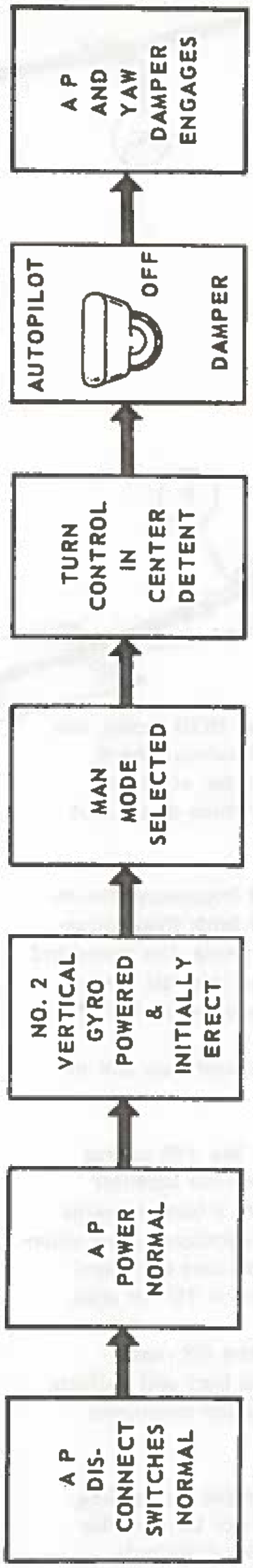


A3 - STBY HORIZ

The Standby Horizon Indicator is powered from the Battery, if emergency DC bus power fails. Essential Radio switch must be on.

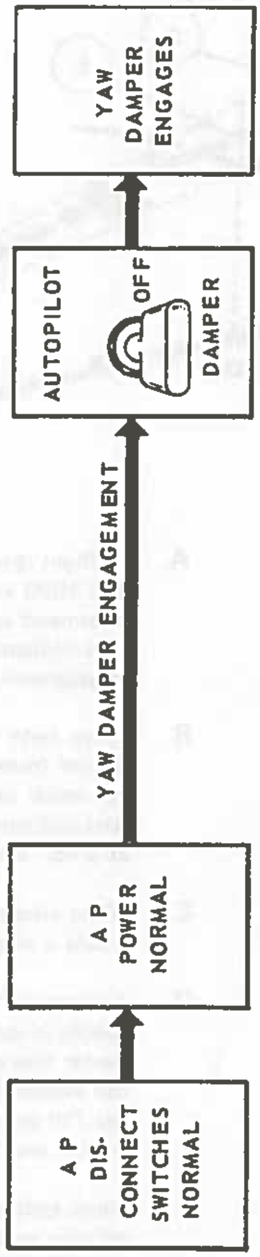
*   *   *

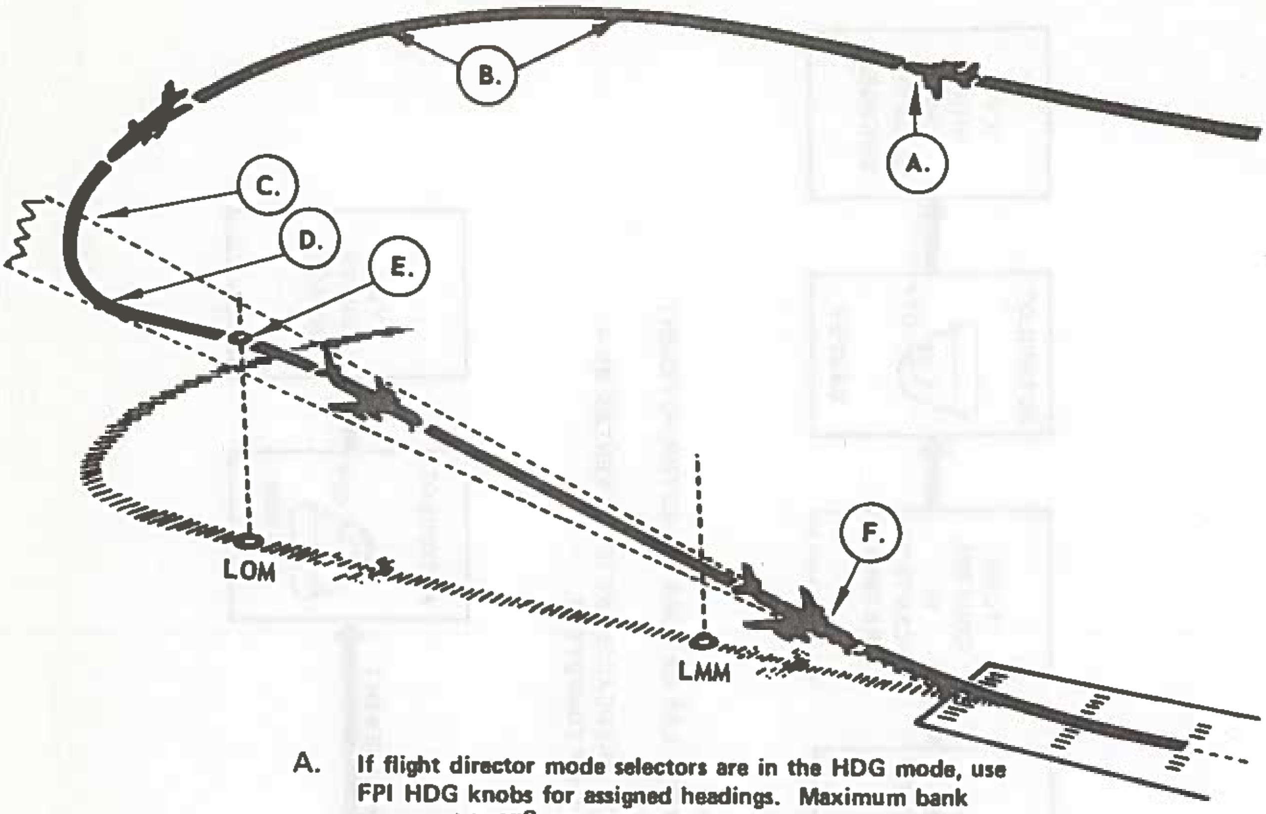
AUTOPILOT INTERLOCK



NOTE

1. AFTER AUTOPILOT IS ENGAGED, TURN CONTROLLER OR MODE SELECTOR MOVEMENT WILL NOT DISENGAGE AUTOPILOT.
2. IF AUTOPILOT IS DISCONNECTED, IMMEDIATE RE-ENGAGEMENT IS PREVENTED BY A FOUR SECOND TIME DELAY ON SOME AUTOPILOT COMPUTERS.





A. If flight director mode selectors are in the HDG mode, use FPI HDG knobs for assigned headings. Maximum bank command is 25°. If altitude hold is selected, command bars indicate pitch needed to maintain altitude at time of engagement.

B. When both VORs are selected to the ILS frequency, the inbound front course set on both FPIs and both flight director mode selectors are in the VOR/LOC mode, the command bars indicate required bank to capture the selected course at a 45° intercept angle. Maximum bank command is 25°.

C. When aircraft is on a 45° intercept, command bars will indicate a wings level command.

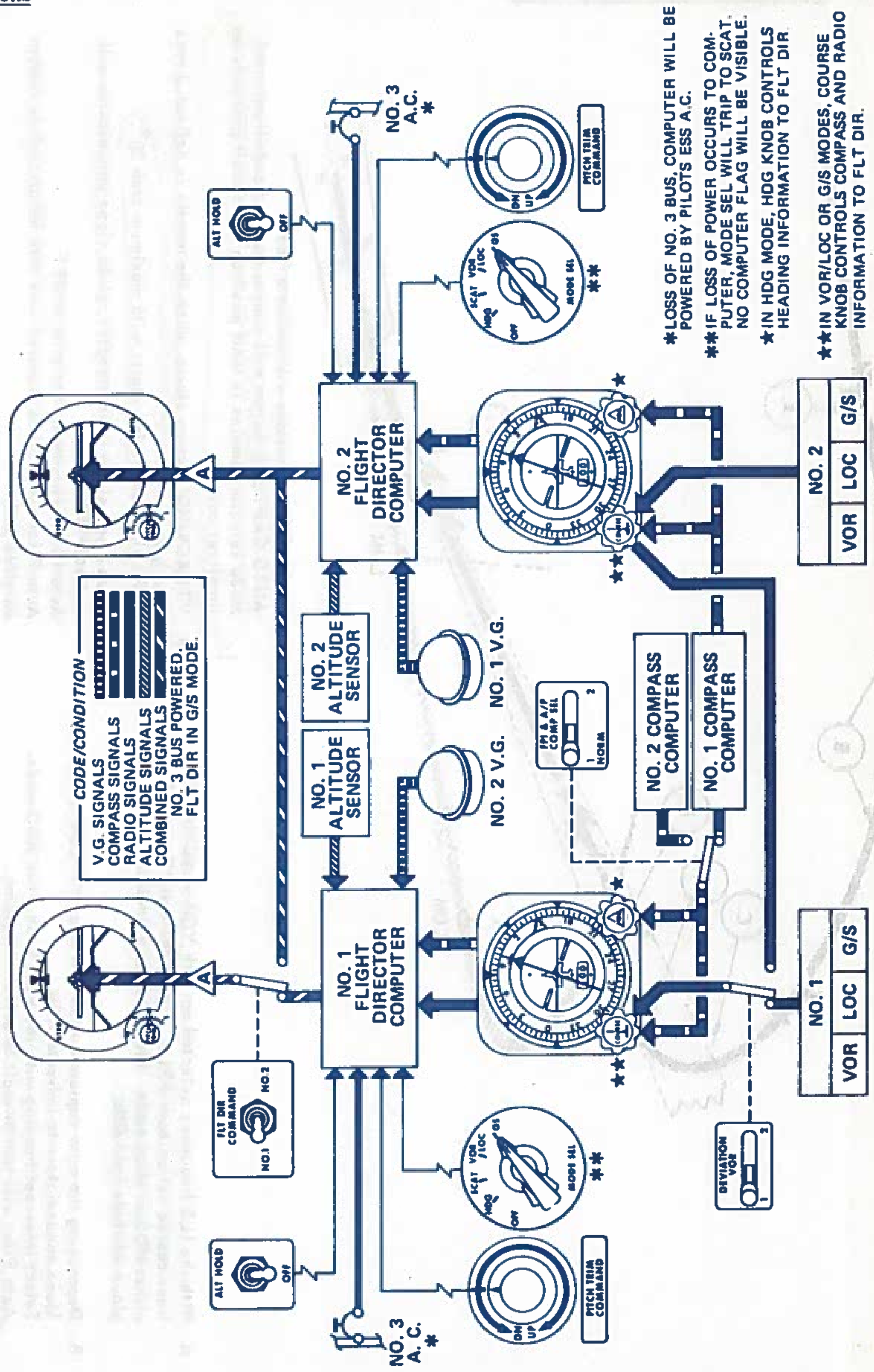
D. A "capture" command is indicated when the FPI course needle is deflected less than two dots from the localizer center line and the command bars indicate a bank towards the inbound front course. Wind drift integration begins when the FPI course needle is deflected less than one dot from center, and the maximum wind integration is 15° of crab.

E. When both mode selectors are placed in the GS mode, altitude hold disengages and the command bars will indicate a fly down command. Maintaining a satisfied command bar will keep aircraft on glide slope.

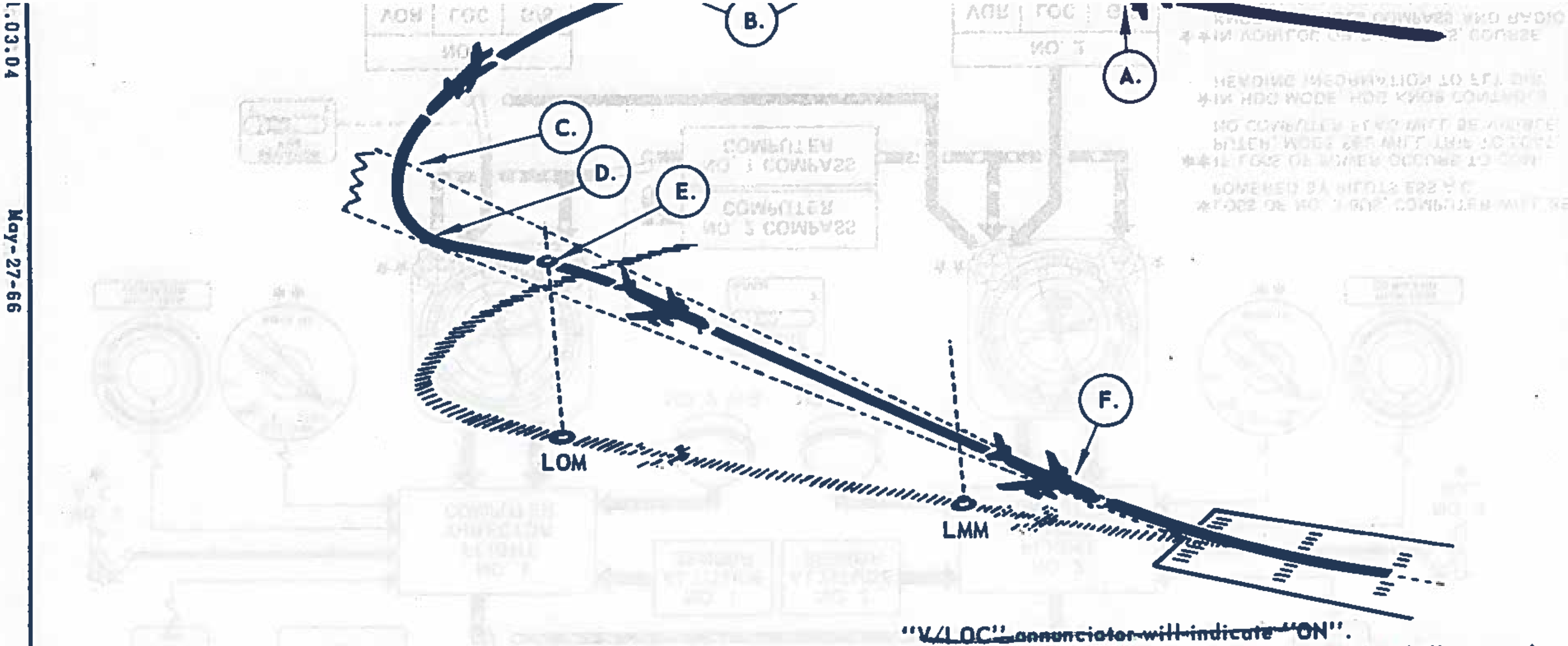
F. When glide slope modes have been disengaged for landing by depressing respective autopilot disconnect button, the mode selectors return to SCAT mode. Initial attitude information for missed approach will be displayed if power is added and rotation is started.

(3730)

C. DUAL FLIGHT DIRECTORS



AUTO PILOT COUPLED ILS APPROACH



A. With the ILS frequency selected on both ~~VOR's and the inbound~~ front course set on both ~~FPI's, engage the Auto Pilot and select either HDG or MAN mode. When reaching final approach altitude, place Altitude hold ON.~~

B. ~~Depressing the auto capture button will cause V/LOC and Glide Slope annunciators to indicate ARM.~~
~~Select intercept heading with the HDG knob, if in HDG mode.~~
~~Auto Pilot will turn aircraft to selected heading.~~
Maximum bank angle is limited to 30° at 4° /sec.
~~If in MAN mode, use turn controller for intercept heading, maximum bank is limited to 35°.~~

C. ~~"CAPTURE" action starts approximately 3 seconds after localizer needle is "alive". Auto Pilot turns aircraft to capture the localizer centerline.~~
Maximum bank angle 30° at 4°/sec.
~~If in HDG mode, selector will return to MANUAL.~~

~~"V/LOC" annunciator will indicate "ON".~~
~~AUTO CAPTURE button will remain engaged and illuminated.~~
Mode selector remains in MAN position as aircraft proceeds on localizer course.

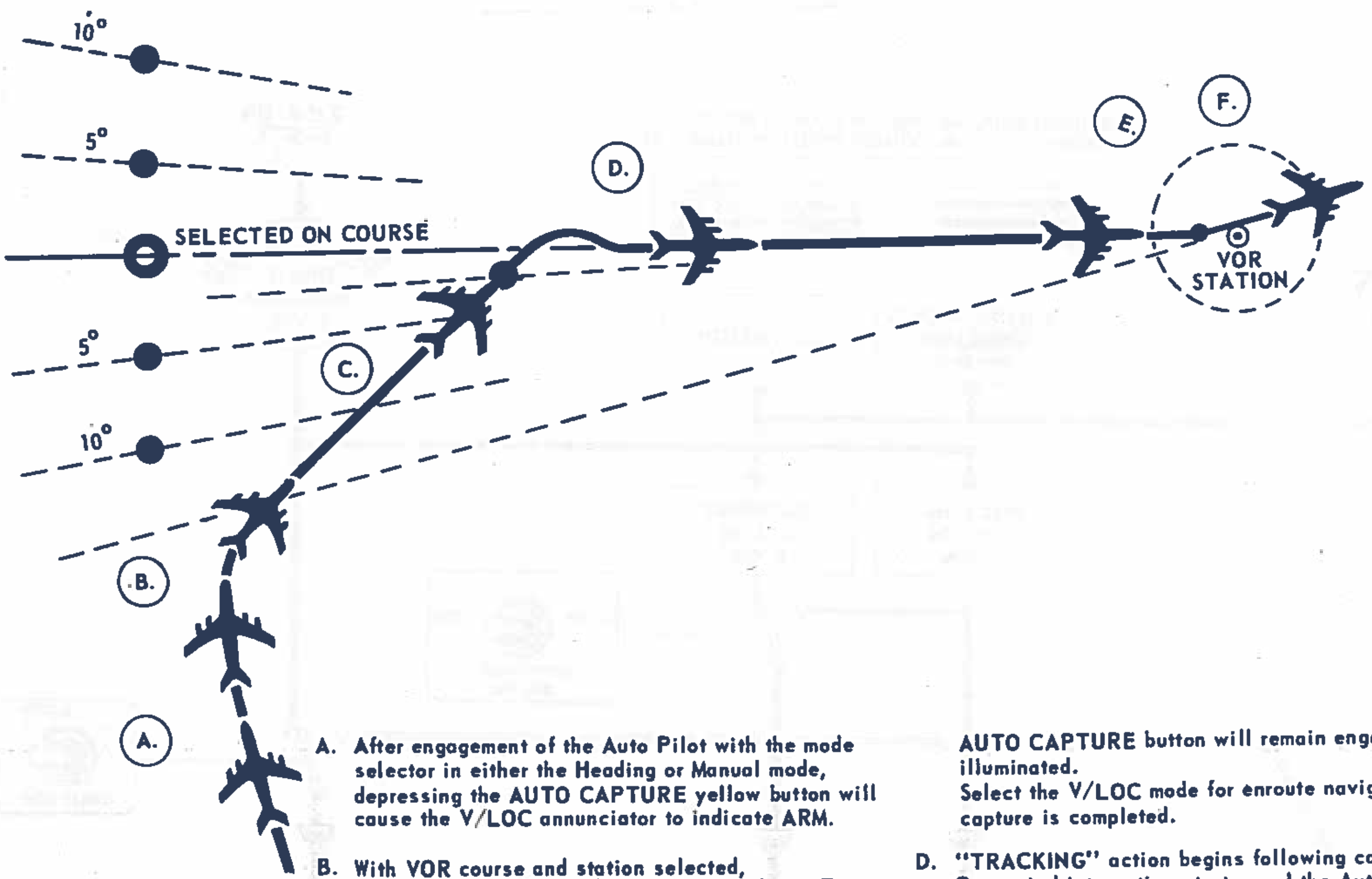
D. ~~"TRACKING" action starts when the needle is deflected less than ½ dot.~~
Crosswind integration starts with maximum crab 20°.

E. ~~When glide slope is intercepted, glide slope annunciator will indicate ON.~~
~~Auto Pilot altitude hold returns to OFF~~
Auto Pilot establishes required sink rate for aircraft to remain on glide path.
Desensitization of the Auto Pilot to localizer and Glide Slope Signals begins and reaches minimum ~~sensitivity after descending approximately 1500 feet.~~
~~Reduces sensitivity to localizer signals 50%.~~
~~Reduces sensitivity to glide slope signals 75%.~~
Rudder will begin receiving Auto Pilot control signals.
After one minute, aileron roll will be decreased from 30° to 17°.

F. Depressing either Captain's or First Officer's Auto Pilot disconnect button will cause the Auto Pilot to disengage.

(3730)

E. AUTOPILOT VOR INTERCEPTION



A. After engagement of the Auto Pilot with the mode selector in either the Heading or Manual mode, depressing the AUTO CAPTURE yellow button will cause the V/LOC annunciator to indicate ARM.

B. With VOR course and station selected, Use Captain's HDG knob, if in HDG mode, or Turn Controller if in MAN mode, to steer the aircraft to a heading for course interception.

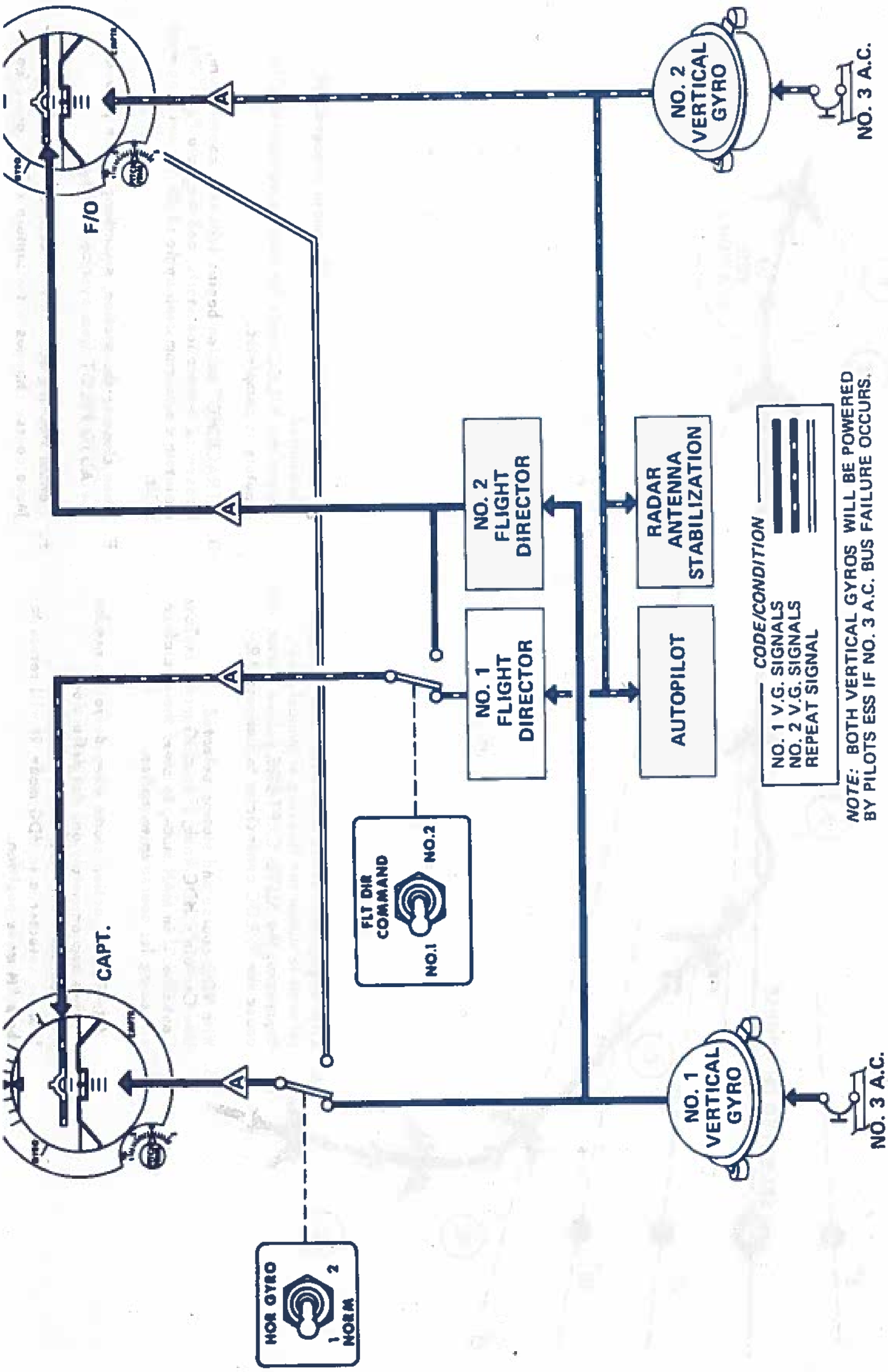
C. "CAPTURE" action starts when deviation needle reaches approximately one dot deflection. Maximum bank angle 30° at 4°/sec. If mode selector is in HDG mode, it will return to the MAN mode position. "V/LOC" annunciator will indicate "ON". AUTO CAPTURE button will remain engaged and illuminated. Select the V/LOC mode for enroute navigation after capture is completed.

D. "TRACKING" action begins following capture turn, Crosswind integration starts, and the Auto Pilot will maintain a maximum crab angle of 20° for existing wind drift.

E. When close to the station, smoothing action prevents the AUTO PILOT from over controlling.

F. Normal tracking action stops until past the station. Make course changes with Captain's FPI course knob.

...VERTICAL GYRO SIGNALS



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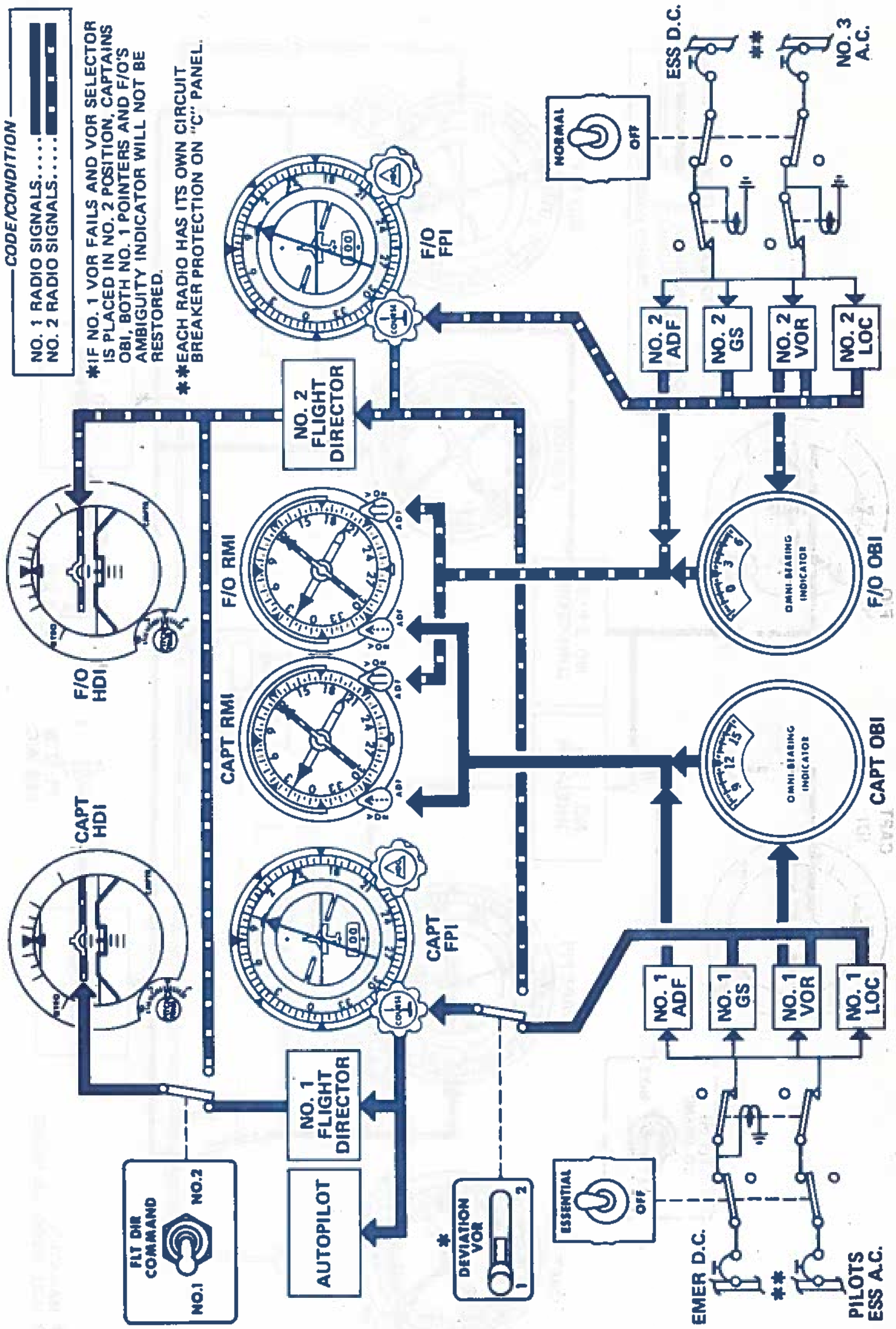
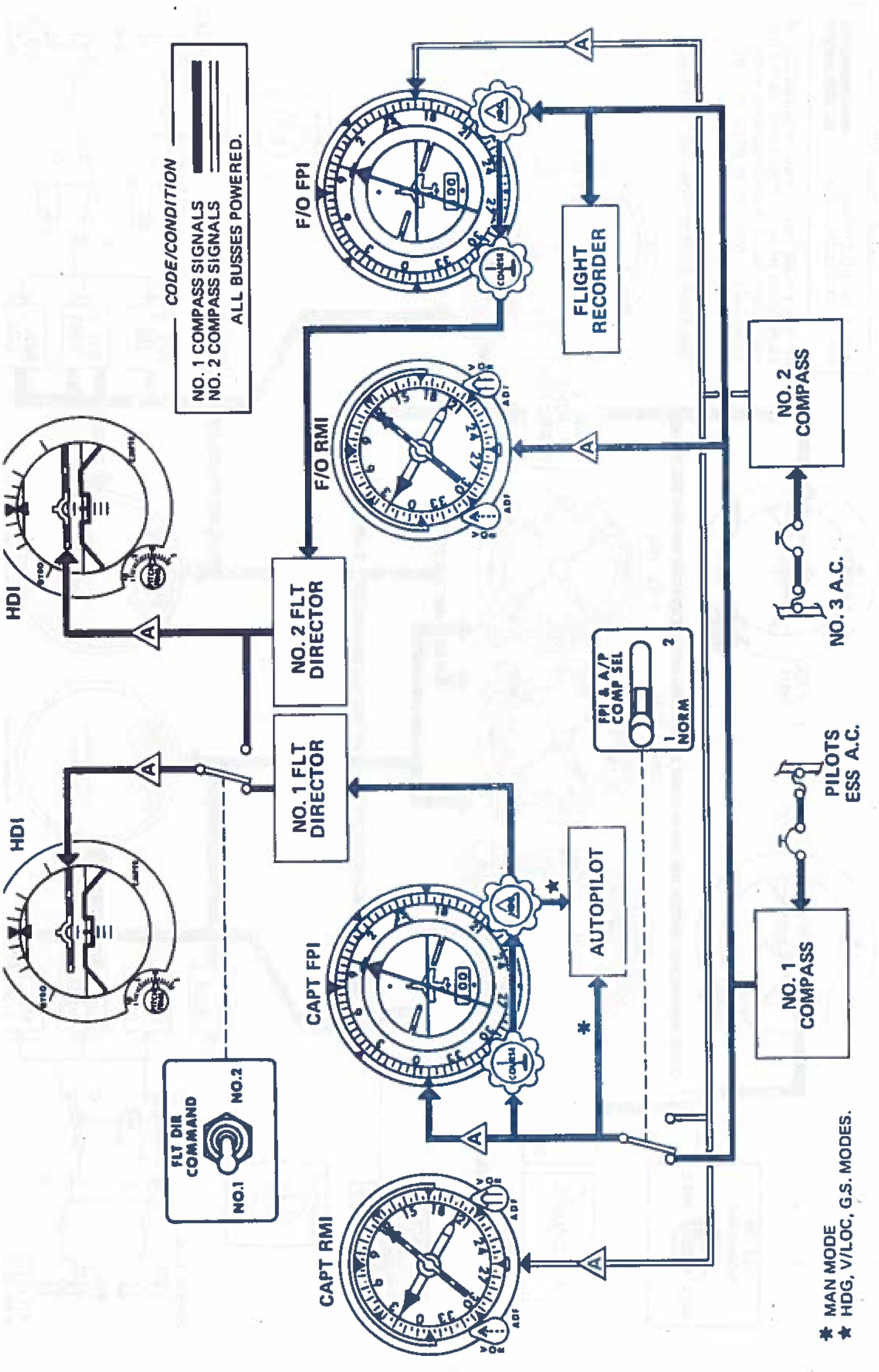
G. RADIO SIGNALS

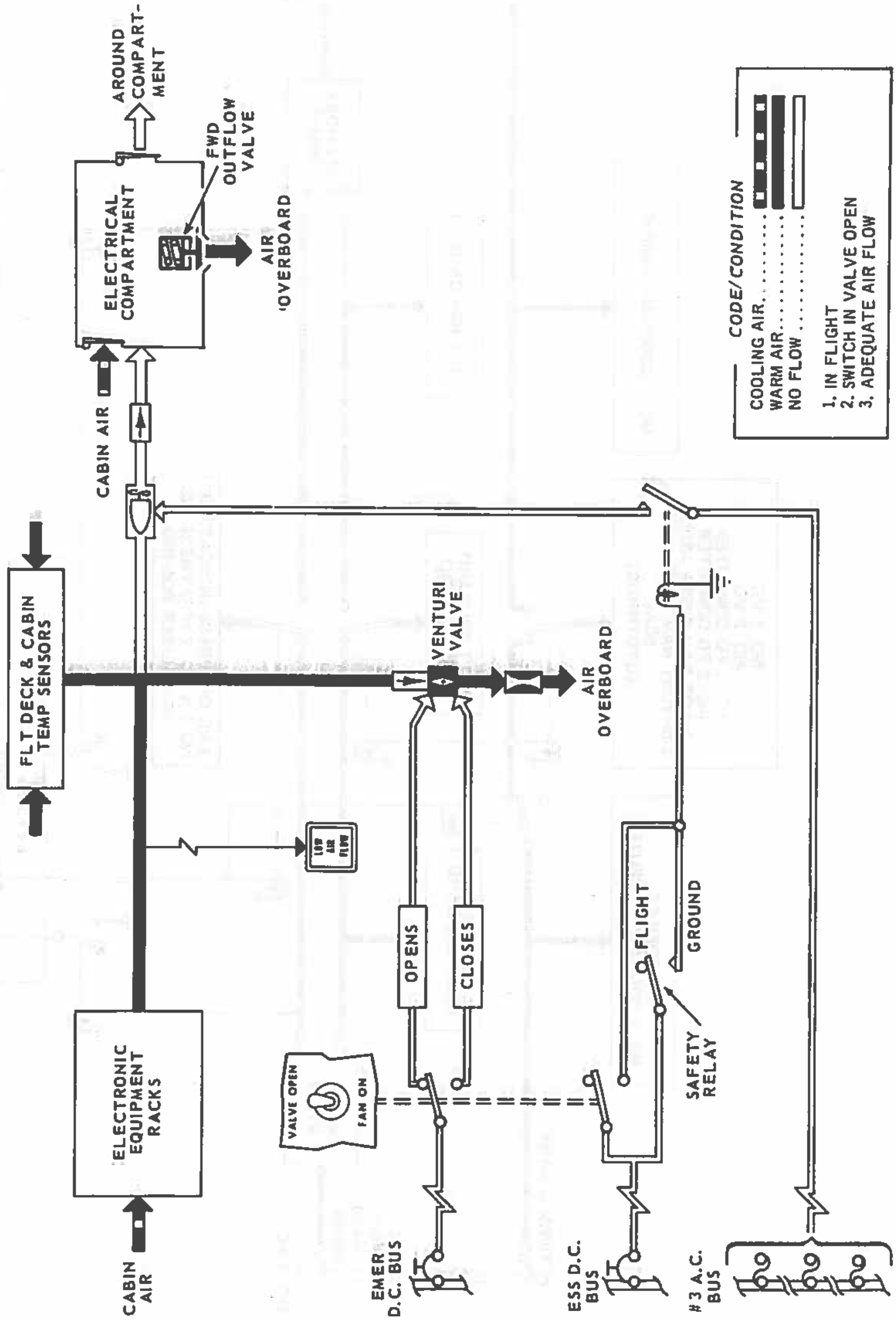


TRANS WORLD AIRLINES
CONVAIR 880
FLIGHT HANDBOOK

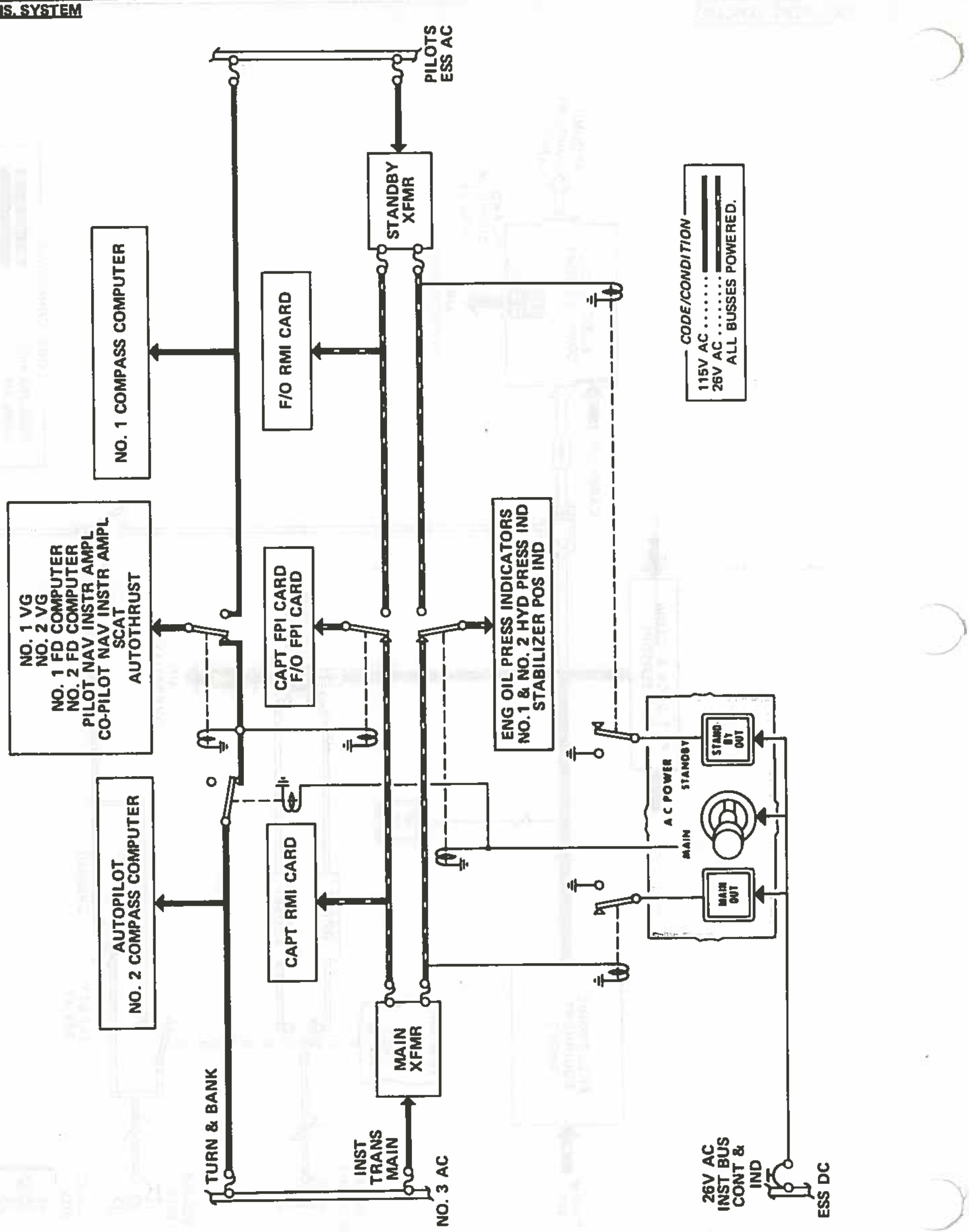
. **COMPASS SIGNALS**



I. EQUIPMENT COOLING



AUTO TRANS. SYSTEM



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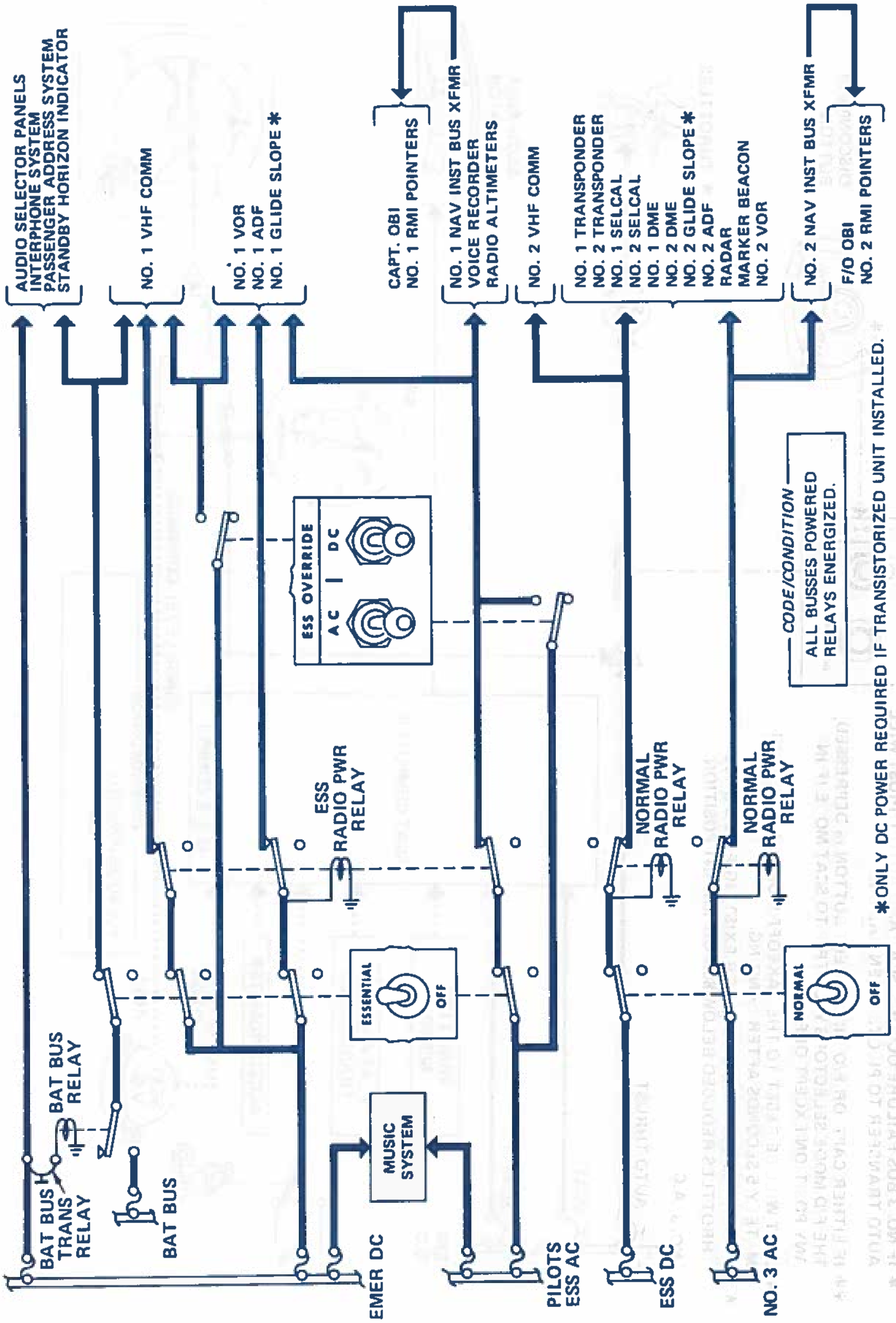
K. RADIO POWER DISTRIBUTION



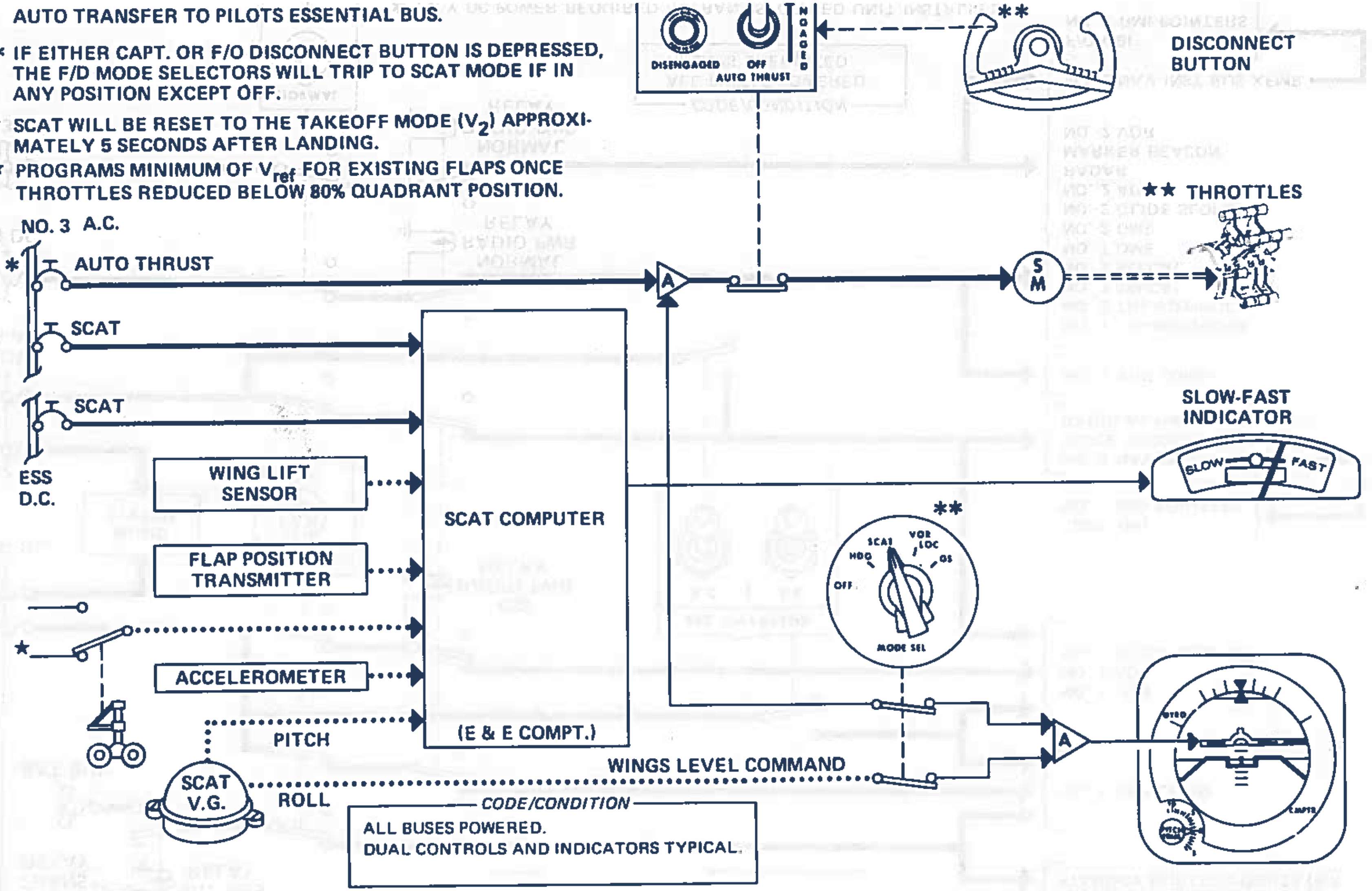
* ONLY DC POWER REQUIRED IF TRANSISTORIZED UNIT INSTALLED.

AUTO TRANSFER TO PILOTS ESSENTIAL BUS.

** IF EITHER CAPT. OR F/O DISCONNECT BUTTON IS DEPRESSED, THE F/D MODE SELECTORS WILL TRIP TO SCAT MODE IF IN ANY POSITION EXCEPT OFF.

* SCAT WILL BE RESET TO THE TAKEOFF MODE (V_2) APPROXIMATELY 5 SECONDS AFTER LANDING.

** PROGRAMS MINIMUM OF V_{ref} FOR EXISTING FLAPS ONCE THROTTLES REDUCED BELOW 80% QUADRANT POSITION.



A. **AUTOPILOT GENERAL**

This autopilot provides automatic maneuvering of the aircraft in a coordinated manner to maintain attitude, altitude and heading references. Also the autopilot system provides automatic tracking of VOR, localizer and glide slope beams when used with the appropriate radio equipment. Yaw stabilizing on manual flight is also provided where the autopilot has control of the rudder only.

The autopilot moves the control surfaces by electric servo motors and mechanical linkage attached to the control tabs. Power to the autopilot is supplied from the No. 3 AC bus and is protected by 3 current limiters at the bus and by an AUTOPILOT circuit breaker (C-11).

This autopilot will capture a VOR or localizer course from any angle if the aircraft is on a heading that will intercept the selected course. An intercept angle must be established since an all angle capture autopilot will not automatically turn to a 45° capture angle.

When the flaps are lowered, the amount and rate of aileron movement is increased.

When the autopilot is engaged the normal electric trim system is deactivated.

B. **AUTOPILOT COMPONENTS**

1. Controller

a. Mode Selector Switch
This is a rotary switch with five positions located on the left side of the autopilot controller. It is spring-returned to the MAN position or magnetically held in any other position. The five positions on the mode selector switch are:

(1) MAN - With the autopilot engaged in this position, the aircraft will be retained on the heading and pitch attitude existing at the time of engagement. Heading can be altered by turning the turn controller knob and pitch can be altered by use of the pitch trim wheels.
(2) HDG - With the autopilot previously engaged, HDG position can be selected and the aircraft will seek and retain the compass heading that is selected with the HDG knob on the captain's FPI.
(3) LOC/VOR - With the autopilot previously engaged, LOC/VOR position may be selected. This will cause the aircraft to capture and track the course selected with the COURSE knob on the captain's FPI.
(4) GS AUTO - In this position the aircraft will continue to follow the localizer beam until interception of the glide slope beam. After interception, both the localizer and glide slope beams are followed.
(5) GS MAN - In this position the aircraft will immediately pitch up or down to seek the glide slope beam and then follow both the localizer and glide slope beams the same as in the GS AUTO position.

b. Auto Capture (Yellow) Button
This button enables the pilot to arm the VOR/LOC capture system (button depressed) while still maneuvering the aircraft in the HDG or MAN mode. With HDG or MAN mode selected and the button depressed, the aircraft automatically captures the selected course upon intercept without selecting LOC/VOR or GS AUTO mode.

The yellow button will not operate unless the autopilot is in HDG or MAN mode.

If the yellow button is depressed and the aircraft is to pass through the course before actual capture is desired, the pilot must pull out the AUTO CAPTURE button before the course needle is "alive". When AUTO CAPTURE is again desired and an intercept heading has been re-established, the autocapture button may not stay in. If not, select GS AUTO for the capture.

Turn Controller operation affects the yellow button in two different ways, depending on aircraft position relative to the course signal.

(1) If aircraft has not captured the course (V/LOC annunciator ARM), the Turn Controller will fly the aircraft in the MAN mode (yellow button remains depressed) and autocapture cannot occur with Turn Controller out of detent.
(2) Once the aircraft has started capturing the course (V/LOC annunciator ON), the Turn Controller will cancel the capture (Button out) and the autopilot will return to the MAN mode.

The autocapture button, once engaged, will now remain engaged if either airborne or ground radio signals fail. The V/LOC annunciator will indicate ON if the localizer transmitter fails, and the GS annunciator will indicate ON if the glide slope transmitter fails. The autopilot will continue to function without those failed radio signals to guide it properly. The appropriate GS or LOC flag will be visible in the captain's FPI as a reminder of failed signals. The autocapture button will release if:

(a) Turn controller is moved out of detent position when in MAN mode.
(b) Mode selector is changed to LOC/VOR, GS AUTO, or GS MAN.
(c) Autopilot is disengaged in any manner.

2. Disengage Switches
These switches are located on the outboard horn of each control wheel. Pressing either of these switches will disengage all autopilot operation and return the engage switch to the OFF position. As pressing either of these switches breaks the magnetic holding circuits, all magnetic clutches are released and all switches return to their spring-loaded positions.

3. Three-Axis Trim Indicator
This indicator is located on the left side of the center instrument panel. It consists of three voltmeters connected across the variable phase winding in the three autopilot servo motors. Deflection of an indicator means that voltage is applied to the motor and it will be either rotating or holding against a force. The autopilot does not need to be engaged to have trim indicator operation.

4. Autopilot Indicator Lights
Two warning lights are located above the three-axis trim indicator on the center instrument panel. The lights are:

a. Autopilot Disengaged Light
This is a red light that will give a flashing warning that the autopilot has disengaged by some means other than pressing either disengage button. The light can be extinguished by pressing either disengage button or the disengaged light. An unusual condition is a steady light indication. This is caused by failure of Emer. DC bus power to the warning light relay. In this condition, the autopilot continues to operate normally but subsequent autopilot failure would not be indicated by a warning light.

AUTOPILOT COMPONENTS

b. Elevator Out Of Trim Light
This is an amber light adjacent to the disengage light that will alert the crew that some trim is required in pitch. The amount of trim will be indicated by displacement of the elevator trim indicator. The light will not come on unless the out of trim condition exists for more than 3 seconds with flaps up or 1 second with flaps down.

5. Power Junction Box
This unit is adjacent to the autopilot computer in the left-hand electrical rack. It converts three-phase AC voltage supplied from the No. 3 bus to all the necessary AC and DC voltages needed by the autopilot. A three-phase AUTO-PILOT circuit breaker (C-11) protects the input circuit to the junction box. Four plug type fuses located on the face of the junction box unit protect the output circuits. Any one of these fuses blown will prevent engagement of any autopilot function.

6. Control Surface Servos
Three electric servo motors are used to control the movement of each main surface control tab. Each servo contains a two phase motor, gear train, engage clutch, torque limit switches, rate generator and a follow-up autosyn.

7. Automatic Pitch Trim Servo
The trim servo consists of a two-phase motor, gear train and engage clutch and is similar in operation to the main servo unit. It is utilized to automatically adjust the aircraft stabilizer whenever there is a constant pitch signal and in turn relieve the aerodynamic load on the elevator controls.

This trim servo is located in the pedestal and will move the stabilizer trim wheel and control cables. No. 1 hydraulic system pressure and the normal trim system is required to accomplish automatic pitch trim.

The normal electric trim switches on the control wheels are made inoperative when autopilot is on and switch operation will not disengage the autopilot.

Automatic pitch trimming should occur whenever the trim indicator is deflected 1 1/2 - 2 bar widths.

8. Air Data Sensor
This unit is located in the left-hand rack in the electrical compartment. It has a static pressure line connected to the autopilot static ports and a pitot pressure line connected to the right-hand pitot head. This unit is designed to convert these pressures into electrical signals for certain autopilot functions.

Static pressure changes cause an aneroid unit to either expand or contract and in turn create an electrical signal for changes of pressure altitude. This signal is supplied to the elevator channel when the altitude hold switch is on. The autopilot should then maintain pressure altitude within $\pm$ 50 feet of the engaged altitude.

Pressure altitude signals also are used when glide slope operations is engaged during a coupled approach. This information is used to decrease both the localizer and glide slope signals to the autopilot. Mechanical stops limit the signal reduction to:

a. Localizer 50%

b. Glide Slope 75%

Decreasing pressure altitude of 1500 feet will move these controls to the mechanical stops and leave the autopilot system with the minimum amount of radio signals during the remainder of the coupled approach.

This desensitizing action is clutched in when glide slope operation is engaged. When making the approach with the mode selector in either glide slope mode, placing the mode selector to LOC/VOR and back to GS MAN will allow the radio signals to return to maximum amounts again.

When making the approach with the autocapture button depressed, moving the mode selector from MAN to GS MAN will allow radio signals to return to maximum again.

9. Three-Axis Rate Transmitter
This unit is located in the left-hand rack in the electrical compartment and contains three gyros on different spin axis. This unit provides electrical signals for changes of aircraft attitude about any axis. Signal information from each of these three gyros is used to apply immediate corrective action in the proper channel. The yaw rate gyro is the only control signal to the rudder with either DAMPER or AUTO-PILOT engaged.

NOTE
The yaw rate gyro does not detect steady state yaw conditions and as a result will not apply any corrective action. The rudder servo will hold the rudder in the neutral position and out of trim will be indicated on the trim indicator if a steady yawing condition exists.

10. Vertical Gyro
The autopilot uses the No. 2 vertical gyro located in the left-hand rack in the electrical compartment. This gyro provides the autopilot with pitch and bank reference signals. The No. 2 gyro must be powered to enable autopilot engagement but is not required to engage the DAMPER function.

11. The autopilot will disengage if any of the following occur:

a. Either autopilot disconnect button depressed.

b. Placing the autopilot engage switch in OFF position.

c. Failure of any of the four fuses on autopilot junction box.

d. Autopilot circuit breaker trips. (C-11)

e. Failure of any of three current limiters on #3 AC bus. (Position #7, 8, & 9)

f. Failure of #2 vertical gyro.

g. Failure of #3 AC bus.

12. The autopilot mode selector will trip to MAN mode but remain engaged if:

a. Turn controller is turned more than approximately 5°.

b. Localizer is captured (HDG mode) using autocapture button.

c. DEVIATION VOR switch is placed in #2 position while in LOC/VOR, or GS modes.

d. COMP SEL switch is placed in #2 position.

e. LOC receiver has DC power failure or LOC/VOR receiver is rechanneled while in GS modes.

B. **AUTOPILOT COMPONENTS**

13. The mode selector remains in GS modes if:

a. Glide slope receiver has power failure.

b. LOC or GS ground transmitter fails or radio signals become weak.

c. Localizer receiver has AC power failure.

C. **FLIGHT DIRECTORS**

Aircraft are equipped with a dual flight director system. The flight director provides a visual presentation for headings, VOR navigation and ILS approaches.

Each system consists of a computer, command bar, amplifier and necessary controls. Signals originate from a vertical gyro, altitude sensor, radio receiver and compass system. The command bar is a part of the HDI, and supplies the visual commands. The FPI course and heading knobs control pre-selected course and heading signals for command bar use.

Electrical power is normally supplied by 115 volt #3 AC bus for computer, amplifier and vertical gyro operation. If this source of power fails, power will automatically transfer to pilots' essential AC bus through autotransfer relay action. Individual computer power protection is provided on C-5 and C-11 panel.

<u>Flight Director Computer</u>
Each computer receives signals from its respective localizer-VOR receiver, glide slope receiver, vertical gyro, altitude sensor and FPI. These signals are combined within the computer and released to the command bar, depending on mode selection. A loss of power to a computer will result in the mode selector tripping to SCAT mode. No COMPUTER flag will be visible if this occurs.

<u>Computer Amplifier</u>
The function of each amplifier is to amplify computer signals for proper command bar presentation. Two relays within the amplifier monitor command and attitude power supplies. Circuit breaker protection is provided on C-11 panel.

<u>Mode Selector Switch</u>
Each mode selector switch provides four modes of operation:

<u>OFF</u>: In this position, the command bar is out of view, and the COMPUTER flag is visible.

<u>HDG</u>: In this mode, the pilot's FPI HDG knob controls pre-selected heading information to his command bar for vectoring.

<u>VOR/LOC</u>: In this mode, the pilot's FPI course knob controls pre-selected course information to his command bar for VOR or localizer operation. The command bar is programmed for a 45 degree course intercept in this mode.

<u>SCAT</u>: If this mode is being used, the SCAT computer will be used instead of the flight director computer. Only SCAT commands will be displayed by the command bar.

<u>GS</u>: This mode is selected when glide slope information is desired. When this mode is selected, both pre-selected course and glide slope signals are used by the command bar.

<u>Flight Director Command Switch</u>
This switch is normally in the #1 position, providing each pilot with a separate system. Placing the switch in the #2 position will enable the captain to monitor the #2 computer. In the #2 position, both command bars will give identical commands. Complete control is then exercised by the first officer's flight director controls.

<u>Altitude Hold Switch</u>
When the altitude hold switch is turned on, altitude sensor information is directed through the computer to the command bar. When engaged, the command bar will reflect changes in static pressure altitude. The captain's altitude sensor is paired with the autopilot altitude sensor in the air data sensor unit. Through a priority relay, the autopilot altitude hold will not engage if the captain's flight director altitude hold is turned on first. Altitude hold for either flight director, will engage only in HDG or VOR/LOC modes.

<u>Pitch Trim Command</u>
Turning this control, sends a signal through the computer pitch channel, adjusting the command bar either up or down. It is inoperative if in either the SCAT or GS modes, or if ALT HOLD is engaged.

<u>FPI Compass Selector Switch</u>
This switch is normally in the #1 position. Placing the switch in the #2 position will enable the captain to use the #2 compass system for his flight director operation. The first officer's flight director can use only the #1 compass system.

<u>Deviation VOR Switch</u>
This switch is normally in the #1 position. Placing the switch in the #2 position will enable the captain to select the #2 localizer, VOR and glide slope receivers for his flight director operation. The first officer's flight director can use only the #2 radio receivers.

<u>Flight Director Disengagement</u>
Each flight director can be disengaged, by either turning the mode selector off, or depressing the respective autopilot disconnect button. If the autopilot disconnect button is depressed while operating in any mode except OFF, the mode selector will trip to the SCAT mode, displaying SCAT commands.

D. **VERTICAL GYROS**

Aircraft are equipped with two fully monitored type vertical gyros. These are located in the electrical compartment, and provide the captain and first officer with pitch and roll signals necessary for instrument attitude indication.

Two types of gyros are in service. One is the older, full speed model (23,000 RPM), and the other is the latest heavy mass, half speed model (11,500 RPM). Both, however, provide the pilots the same capability, and are identical in performance.

Each gyro assembly consists of a motor assembly; torque motors for gyro erection; autosyn synchros, for sensing pitch and bank displacement. The erection torque motors and pitch and bank synchros are mounted on the gyro pitch and bank gimbal pivots.

D. VERTICAL GYROS

Each gyro has 360 degrees of movement about the roll axis, and 85 degrees movement in up and down pitch movement.

The initial erection rate has been tripled from the previous, nonfully monitored gyros. The initial erection cycle is now accomplished at a rate of 10 to 15 degrees per minute when the gyro motor wheel is rigid, and much higher on a non rigid wheel. After the initial erection cycle is completed, the gyros will remain in a normal erection rate of approximately 2 degrees per minute for normal flight operation. Bank erection cut-off is not overridden after five minutes, as on previous gyros, but remains cut-off until wings are level. This prevents erecting to a false vertical, then re-erecting to the normal vertical upon wings level.

The term "fully monitored" itself, means any foreseen malfunction inside the vertical gyro will be detected, producing a fail flag on the affected HDI. In event the #2 vertical gyro fails, the autopilot will disconnect, if engaged, preventing it from following a tumbled gyro. More parameters are monitored than on previous gyros. Functions now monitored are:

- Gyro erection system
- Gyro speed
- Pitch and bank autosyns
- Pitch and bank torquers
- 115 AC input
- Internally produced DC power

After any power interruption of approximately 45 seconds, and power is reapplied, the erection rate will revert from the slow mode to a fast erection mode. Automatic transfer from fast to slow erection mode can occur only when:

- Rotor speed is 3/4 full speed, and
- Bank axis is level within 6.5 degrees, and
- Pitch axis is level within 3.7 degrees.

At this point normal erection is established, and continues to erect and hold the gyro within 1/4 degree of vertical.

The gyro motors are normally powered from #3 AC bus, single phase power. If this bus power fails, then power is supplied automatically from the pilots essential AC bus, through the autotransfer circuit. Circuit breaker protection for both the #1 and #2 vertical gyros is provided on C-5 and C-11 panel.

E. YAW DAMPER

The yaw damper is a "part-time" yaw damper, and is designed to remove any "dutch roll" tendencies of the aircraft. Placing the autopilot engage switch to DAMPER engages the yaw damper by engaging the rudder servo motor. This positions the rudder control tab in response to oscillatory yaw rate signals. A rate gyro senses yaw rate. Constant displacement of the rudder trim index, on the three axis rate indicator, will be seen if the yaw damper is engaged with the rudder deflected from neutral position.

F. SCAT

The SCAT system (speed command of attitude and thrust) senses lift, horizontal acceleration and pitch attitude. The system consists of a SCAT computer, slow-fast indicators, wing lift sensor, vertical gyro, flap position transmitter, accelerometer and command bars. The SCAT computer combines signals from the SCAT vertical gyro, wing lift sensor, accelerometer and flap position transmitter. The slow-fast indicators function regardless of the flight director mode selector position. The mode selector must be in the SCAT mode for the command bar to indicate SCAT commands.

The wing lift sensor is located on the underside of the right wing leading edge. The lift signal is obtained from this sensor unit. It senses airflow direction and force in the vicinity of the wing airflow dividing point. Lift signals are influenced by angle of attack, airspeed, flap position and weight.

An accelerometer provides horizontal acceleration and deceleration signals and is not influenced by pitch attitude. The mixture of wing lift signals and accelerometer signals, results in smooth variations in aircraft control while undergoing such changes as flaps, gear, wind gusts, engine out conditions.

The SCAT system has its own vertical gyro. When in the SCAT mode the command bar will show limited pitch commands up to a maximum fly up command of 15 degrees. The command bar, while in SCAT mode, will also provide a wings level command. If a turn is desired, while in SCAT mode, the command bar will provide the pitch command, but will not provide banking commands other than for keeping the wings level.

The flap position transmitter is located at the forward end of the hydraulic compartment. It provides signals to the SCAT computer to compensate for each given flap setting.

The slow-fast indicator can be used as a reference for speed control during an approach. Since the command bar will probably be used in a flight director mode, SCAT display will not be provided by the command bar. However when the flight director is disconnected as in missed approach procedures, the mode selector will return to the SCAT mode. The command bar will then display attitude information for execution of a missed approach, if power is added, and rotation started. The slow-fast indicator will be centered if at the proper speed for a given flap setting. The speed reference for the givenflap settings are as follows:

Flaps Up. . . . . . V_{ref} + 50 Kts.
Flaps 20 . . . . . V_{ref} + 30 Kts.
Flaps 30 . . . . . V_{ref} + 20 Kts.
Flaps 40 . . . . . V_{ref} + 10 Kts.
Flaps 50 . . . . . V_{ref} + 5 Kts.

The slow-fast indicators will indicate slow if any of the following conditions exist.

1. Wind gusts: The effects of gusts on wing lift will be integrated so as to increase the SCAT reference to approximately one half of the peak gust intensity.
2. High sink rates: At rates of descent greater than approximately 700 feet per minutes, SCAT will command enough additional speec to provide flarecapability without deceleration to an unsafe speed.

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F. SCAT

3. Turns: When turning, SCAT will compensate to provide a safe constant margin above stall speed.

The SCAT system is designed for either three or four engine operation. The command bars can be used for either takeoff or missed approach if in the SCAT mode. The amount of fly up command for takeoff is programmed to maintain a minimum of V_2 speed. This basic reference speed for takeoff will automatically change to V_{ref} when one engine on each side of the aircraft is reduced below the 80% thrust position. V_{ref} will be the reference speed used by SCAT during an approach or missed approach. After the landing, when weight has been on the landing gear for more than five seconds, the SCAT system automatically changes to takeoff reference V_2.

The SCAT computer will monitor and provide fail warning indications if any of the four signal inputs fail:

Vertical gyro
Wing lift
Accelerometer
Flap transmitter

In addition, if a roll command signal is maintained for longer than 90 seconds, with a bank of 7 degrees or more, the SCAT system will also fail. If this occurs, the SCAT system will be restored when wings are again level.

If in the SCAT mode when any of the above failures occur, the command bar will go out of view, COMPUTER flag will appear and slow-fast fail flags will appear. If not in the SCAT mode, only the slow-fast fail flags will appear.

G. AUTOTHRUST

Autothrust is designed to provide automatic speed control during the approach. When engaged, the system adjusts throttles to maintain not less than V_{ref} speed for existing flap setting. It is used only during the approach phase and is approved for either three or four engine operation. It can be used for any approach in which SCAT is approved, in combination or separate from flight director, or autopilot.

The system consists of an autothrust amplifier, servo clutch assembly and SCAT computer. The servo clutch assembly contains a servo motor, irreversible gear box and four sets of pulley clutch units, mounted overhead in the electronic compartment. The servo motor has a maximum output speed to limit throttle travel to 6 degrees per second with a maximum signal input. The amplifier sends a signal to drive the servo motor in the desired direction and to give the desired speed of throttle movement. A switching circuit in the amplifier prevents the throttles from being retarded below approximately 12 degrees from the idle position. The throttles may be manually overridden at any time, regardless of position.

The autothrust system is engaged when the autothrust switch, located on the glare shield, is turned to the up or ENGAGED position. The system may be disengaged by turning this switch to the OFF position or depressing either autopilot disengage button. When disengaged by any means, the autothrust disengage light will flash. To extinguish the light, push it to reset. The system will automatically disengage if power fails to the system's amplifier, or a loss of SCAT signals occurs.

Normal electrical power is supplied by the #3 AC bus. If this power fails, then the system is powered automatically by the pilot's essential AC bus, through the autotransfer circuit. Circuit breaker protection is provided on C-3 panel, by a breaker labeled AUTOTHRUST.

SCAT signals are sent to the slow-fast indicators and autothrust amplifier, when autothrust is engaged. When the slow-fast pointers are centered, autothrust is satisfied, and throttles will not move. When in a "slow" position, throttles will move forward to increase speed. When in a "fast" position, throttles will retard to decrease speed.

H. DME

Distance measuring equipment is a system combining ground based and airborne equipment to measure the slant range of the aircraft from a selected ground site. The airborne equipment transmits sequenced interrogation pulses which cause the ground station to transmit reply pulses. The airborne equipment measures the time between the transmitted and received pulses and converts time to nautical miles. The DME and transponder "share time" in that when one is sending a pulse the other is suppressed.

The VOR control unit controls the DME system. The DME system is in operation when the VOR is tuned to a VORTAC frequency, and the DMET switch is placed in the DMET position. Placing this switch to the STANDBY position enables the equipment to warm up properly and stops the nautical mile readout. The equipment automatically goes into a "standby" mode when a proper ground station is not available or when the ground station signal is too weak to be usable. If this occurs, the transmitter is turned off, the search operation stops, the flag appears on the digital indicators, and the system is in "standby" in all respects except that the switch on the control panel is not moved. When a usable ground station signal reappears, the system will automatically start operation.

A dual presentation digital indicator is provided for each pilot. The maximum range presented on this indicator is 200 nautical miles, providing the VOR control switch is in the OVERRIDE position. The search range is limited to 50 nautical miles when a station is selected below 112.0 MHZ and the VOR control switch is in the NORMAL position. A flag alarm is provided to indicate: power failure to the system, or system is in a "search" mode, or in the standby mode.

The DME audio is fed to the flight crew's audio selector box, and identification is possible if the DMET toggle switches are placed in the DMET position.

Electrical power required is taken from the #3 AC load bus and the essential DC load bus. This power is controlled by the NORMAL radio switch. Circuit breaker protection is provided on C-4 panel and labeled No. 1 and No. 2 DMET.

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STABILIZER TRIM SETTING

The takeoff trim setting will be computed using the stabilizer trim computer. This is located in the pouch on the back of the first officer's chair. The engineer is responsible to ensure the computer is returned to this pouch on flight termination.

If the computer is missing, the trim chart in the Flight Handbook 15.35 section will be used, to determine trim setting. The missing computer will be noted in the logbook.

Use the basic reference number (BRN) in chapter 15. For each ACM in cockpit, reduce BRN one unit and add 190# to aircraft operating weight.

USING THE TRIM COMPUTER

Set hairline at BRN.

Without moving hairline, set zero line for total fuel scale under hairline. If standard fueling sequence is not followed, individual tank fueling scales will be used.

Move hairline to fuel load.

Move slide to set zero line for belly cargo compartment under hairline.

Move hairline to forward cargo load.

Repeat previous two steps for aft cargo load.

Move slide to set zero line for forward and aft passengers.

Move hairline to forward passengers.

Repeat previous two steps for aft passengers.

Locate stabilizer trim setting shown on solid line that intersects weight scale nearest the gross takeoff weight of the aircraft.

If determination of C.G is desired, use the intersection of gross weight and the upper solid line or dotted line extension. Follow the dotted extension to percent MAC.

PASSENGERS IN WEIGHT SLIP BOX

The numbers of passengers on the weight slip are classified First Class and Tourist. For trim computation, however, passengers must be classified as Forward or Aft, with the dividing line being the center of the wing emergency exit.

With the class divider located in Row 7 (just forward of the exit), First Class passengers are Forward passengers and no adjustment in numbers is necessary. If the class divider is located other than in Row 7, the number of passengers seated between the class divider and the center of the emergency exit should appear on the weight slip in the box to the left of the passenger count spaces.

Should the class divider be located to the rear of the wing exit, the number in the box should be subtracted from First Class count and added to Tourist count to determine the Forward and Aft passenger count for computing trim.

Should the class divider be located forward of the wing exit (other than in Row 7), the number in the box should be subtracted from Tourist count and added to First Class count.

CABIN CARGO LOADING

When cargo is being carried in the cabin, it is to be properly secured using suitable containers in the aft most tourist seat rows. The average weight is not to exceed 170# per seat space.

To determine stabilizer trim setting, consider each seat used for cargo as being occupied by a passenger and add to the aft passenger count. Weight slips will list the number of seats used for cargo alongside the total cabin cargo weight shown on the form.

* * *

A. TEST FLIGHTS

1. Flight test forms for each type TWA aircraft serve as a guide for flight crews conducting a test flight.

2. Technical Services personnel will provide the appropriate Test Flight form to be completed by the crew. If a Test Flight form is not available for any reason, recommended flight test procedures may be obtained through the MCI Maintenance Coordinator or through Regional Maintenance-European at Overseas stations.

3. The test crew will list any malfunctions in the aircraft log book and note if the test flight is satisfactory in the comments section of the log book.

B. POST-LANDING INSPECTION REQUIREMENTS

1. An inspection procedure must be accomplished, prior to the next flight, for the following reported conditions:

   a. Hard Landing or Off-runway landing.

   b. Landing above maximum structural landing weight.

   c. Exceeding flap-down limit speeds.

   d. Exceeding gear-down limit speeds.

   e. Whenever an outboard engine nacelle contacts the ground.

2. Should any of the above conditions occur during flight, an entry must be made in the aircraft log to alert maintenance and avoid unnecessary delay in returning the aircraft to service.

3. Specific Inspection requirements are outlined in the Maintenance Manual, Chapter 51.

4. A log book sign-off, indicating the accomplishment of the required Inspection procedure, must be made prior to the next flight.

*　　*　　*

Flight Crew Information Bulletins (FCIB) are prepared to ensure that flight crews are aware of modifications, special installations, or other unusual systems which may affect aircraft operation from a flight crew standpoint. The FCIB is placed in the holder of specific aircraft only if the information is not available from one or more of the following sources:

Flight Handbook
Flight Operations Training Bulletin
Flight Operations Bulletin
Flight Operations Teletype Message

Whether or not an FCIB should be in the holder is indicated by a placard mounted on the FCIB holder. The Director - Flight Test, controls FCIB information and the placards on each aircraft.

Information on special or test installations of approximately 90 days or less are covered by an FCIB to avoid multiple flight handbook revisions of short duration.

The FCIB folder is not a required item for the purpose of dispatch release. If the placard indicates "FCIB PROVIDED" but the FCIB folder is missing, the discrepancy should be noted in the aircraft logbook.

* * *

LOGBOOK POLICY & GENERAL INSTRUCTIONS

The logbook is required by FAA regulation. It must be aboard the aircraft at departure.

The logbook is the official source for the following information:

Record of engine and aircraft performance.

History of aircraft malfunctions and corrections.

Record of operating time on aircraft and accessories.

Aircraft and engine performance data recorded within the heavy black lines are used in a data storage and performance analysis system. When recording this information, every block must have data or a zero entered. Failure to fill all blocks within the heavy black lines prevents teletype forwarding of the information.

Entry of information other than malfunctions in the Malfunction section should be held to a minimum. When the crew feels an information type entry is necessary, it must be prefaced with a prominent heading and not numbered.

When Maintenance desires to make a notation or to present some information to the flight crew, they will use a blank page, insert the information in the right-hand column and place a large "X" in the left column.

Use the first officer's indicator, when two identical instruments are available from which to record data.

Take performance readings with anti-icing systems that use bleed air turned off.

RED CIRCLE LOG ENTRIES

A malfunction item should be designated a red-circle item when the captain determines that it must be corrected before the flight can proceed. A red circle placed around the number preceding a malfunction item makes it a mandatory repair item and grounds the aircraft until corrections have been made.

REPETITIVE SQUAWK LOG ENTRIES

Any malfunction item, not red-circled, that appears consecutively in the log book for three successive flights should be designated as a repetitive squawk at the termination of the third flight. This is done by affixing the letters (REP) in red on the page margin preceding the item number.

The repetitive classification is valid regardless of Maintenance repair actions taken, as long as the component continues to malfunction. The item continues to be repetitive after each succeeding flight until fixed.

A single malfunction item may be written up on each leg of a particular flight but will be considered as only one flight squawk at the termination station of the flight.

The burden of success of the repetitive squawk program lies primarily with the flight crew. Corrective action taken prior to a flight should be checked enroute, whenever possible, so that the continuity of flight squawks can be maintained if the fix was not successful.

COMPLETION INSTRUCTIONS

Each log page must have at least the crew names, flight number and date, captain's signature, station, gross weight, fuel, flight times, oil add and airplane number information. If unable to enter the remaining information, leave the blocks empty. All recordings are subordinate to the safe operation of the flight.

When no change of crew or flight number occurs, one log page may be used for up to five flight legs.

The performance portion within the heavy lines should be completed on a flight leg of 1:30 hours or more. Plan to record the data on the longest planned flight leg that exceeds 1:30 hours. Take cruise readings as soon as stabilized thrust and speed is established. Even when long flight legs are flown it is preferable to record data at the heaviest gross weight available.

Flight legs over 6 hours should have two log sheets completed, with zero's entered in the "aircraft time" and oil add spaces in the second page.

1. Airworthiness Release, Maintenance Done, Log Checked and Station/ Date.
   These four boxes will be completed by Technical Services personnel, when required, and are not the responsibility of the flight crew.

2. Doppler Data (International only)

3. Flight Number and Date
   Enter flight number by the day of origination, based on local standard time. Example: Flight 95 originating on January 20, local standard time, is entered as 95-20.

4. Crew Names and Domicile
   Enter last name, initials and domicile code for the operating crew.

5. Captain's Signature
   The captain's signature denotes his review and approval of the log page.

6. Station
   Enter the station code for departure and arrival station of the flight leg covered by the log entry.

7. Takeoff Gross Weight
   Enter the takeoff gross weight listed on the flight weight slip or as computed by the crew at stations not served by TWA load control personnel.

8. Takeoff Fuel
   Enter the release fuel load in pounds.

9. Takeoff Temperature
   a. Enter the takeoff temperature (°F) used to determine takeoff thrust.
   b. The I and D blocks do not apply to the 880.

10. Category 2 Approach
    a. Satisfactory/ Unsatisfactory (S/ U)
       When making either an actual or practice approach using Category 2 procedures and equipment, cross out the letter not correct. If the approach is unsatisfactory due to improper functioning of the aircraft equipment enter the cause as a malfunction.

COMPLETION INSTRUCTIONS

b. Runway
When a Category 2 entry is made, indicate the runway used including the designation left (L) or right (R) when required.

11. Landing Weight
Enter aircraft gross weight at time of landing for the respective leg.

12. Air Time
Use Greenwich times, based on the 24 hour clock, for OUT, OFF, ON and IN times. Air time is from OFF to ON.

Enter the total air time for flight legs on the log in the performance data portion. If air time less than 10 hours, enter a zero in the first block.

13. Oil Add
Enter quarts of oil added to each engine as noted on the fuel servicing form. If no oil is added, enter a zero.

Enter the total oil added to each engine for all flight legs on the page. Make these entries in the performance data section. If the total oil added to a particular engine is more than 9 quarts, enter a dash (-) in the block and record as a code 7 flight remark.

14. Leg
Enter the flight leg (1, 2, 3, etc) on which the performance data was recorded in the block marked "LEG."

15. Pressure Altitude
Enter the first three digits of the indicated aircraft pressure altitude.

16. Gross Weight
Enter the first four digits of the aircraft gross weight at the time performance readings were taken.

17. Static Air Temperature (SAT)
Enter the indicated static air temperature in the second and third blocks. For temperature below zero, enter a "-" in the first block. If temperature at or above zero, enter a "0" in the first block. Example: 020 is +20°C.

18. Ram Air Temperature (RAT)
Enter the indicated ram or total air temperature in the second and third blocks. If temperature is below zero, enter a "-" in the first block. If temperature is at or above zero, enter a "0" in the first block. Example: -20 indicates -20°C.

19. Indicated Air Speed (IAS)
Enter the indicated airspeed.

20. Mach
Enter the indicated to the nearest .001 Mach.

21. Turbocompressor (T/C) RPM

a. Enter the first two numbers of each indicated turbocompressor RPM. Enter left hand T/C values in L blocks and right hand T/C values in the R blocks. Enter zeros in the C blocks.

b. Enter "-" in blocks where Alternate Source is used instead of a T/C.

c. Enter zeros in blocks where no T/C or Alternate Source is used.

22. Log Page Number
Copy, from the log page on which you are recording data, the last three digits of the page number. This number is used to ensure proper sequencing of the data in the computer program.

23. Engine Pressure Ratio (EPR)
Enter indicated EPR to the nearest .01 EPR.

24. N_1 (RPM)
Enter indicated RPM to nearest .1%. When RPM exceeds 100%, enter second, third and fourth numbers. Example: 102.3% is recorded as 02.3. Enter 100% and 100.1% as 001.

25. Exhaust Gas Temperature (EGT)
Enter indicated EGT to the nearest degree.

26. Fuel Flow (F/F)
Enter indicated fuel flow to the nearest 50 pounds.

27. Throttle Position
Designate relative cruise throttle position. Consider the throttle quadrant scale from 1 to 10. One number equals 1/2 knob width. Indicate #1 throttle position in the first block and relative position of remaining throttles in remaining blocks. Example: 7, 7, 5 and 7 indicates #3 throttle is one knob width behind the remaining throttles. Do not use tenths such as 7.5, 6.3, etc., since only whole numbers can be recorded.

28. Oil Temperature
Enter the indicated oil temperature to the nearest degree. If temperature over 100°, enter the last two significant temperature numbers. Example: 110° is entered 10. Enter 100° and 101° as 01.

29. Oil Pressure
Enter the indicated oil pressure to the nearest pound.

30. Airborne Vibration Monitor (AVM)
Enter the #1 (D) and #2 (T) position indicated values to the nearest 0.1 mil.

31. Flight Remarks
Space is provided to indicate the four most significant flight remarks that can be coded using the code provided on the log page. This portion of the performance data need not be completed until the last leg on the log page.

Indicate engine number in the first block and the appropriate code number in the second block on any line. More than one remark may be shown for an engine. Example: For a #2 engine EPR log remark, enter 26.

Code 8 should be used for combinations of codes 1 through 5. This code presumes EPR alignment.

Enter zeros in any unused blocks.

32. Plane Number
Enter the assigned four digit TWA aircraft number preceded by a zero. The plane number should be entered on all log pages, regardless of whether time or flight leg duration required completion of the entire data portion of the log.

33. Date
Enter the date of the first leg based on Greenwich time. Since the months of January (01) through September (09) have only one number, enter a zero in the first block for these months. Enter the last number of the year in the last block. Example: January 21, 1965, is entered 01215.

C. COMPLETION INSTRUCTIONS

32. Plane Number
Enter the assigned four digit TWA aircraft number. The plane number should be entered on all log pages, regardless of whether time or flight leg duration required completion of the entire data portion of the log.

33. Date
Enter the date of the first leg based on Greenwich time. Since the months of January (01) through Septemer (09) have only one number, enter a zero in the first block for these months. Enter the last number of the year in the last block. Example: January 21, 1965, is entered 01215.

34. Malfunction/Work Performed

a. Red Circle (1) and Repetitive (REP) symbols should be carried over in red to the duplicate pages as well as the original.

The captain will review the malfunctions listed in the log book prior to the arrival at each station to determine the status of the items.

(1) Red Circle
Those items which must be corrected before the flight can proceed will be circled in red, designating them as mandatory repair items and grounding the aircraft until the corrections can be made.

(2) Repetitive
After a single non-red circled flight squawk has been written up in the log book on three individual consecutive flights (even though Maintenance corrective actions have been taken) the item is to be classified as a repetitive squawk item at termination of the third flight. The item continues to be repetitive after each succeeding flight until item is fixed.

A single non-red circled flight squawk may be written up on each leg of a particular flight, however, at termination station of the flight, this constitutes but one flight squawk.

b. Only malfunctioning items should be numbered. Leave a blank line between items to eliminate misinterpretation.

Anything but a complete fix of a malfunctioning item requires another entry of the item on a subsequent flight. Note the differences in operating conditions encountered, such as altitude, temperature, etc.

c. Flight Crew shall not sign off malfunctioning items entered in the log. It is permissible, to provide Technical Services with useful information, to note in the log that a previous malfunctioning item was not encountered on a subsequent leg. The note will not be considered a sign off for the malfunctioning item.

d. Deletions or alterations to item write-ups or engineering and comment notes must be accomplished in the following specific manner. Draw a single line through the word, or words, so that the deleted material is still discernible. The word VOID, boldly written across the page, should be used when necessary to void an entire log page.

e. The comment portion of the lóg page may be used for malfunctioning items when the words "Comments and Engineering Notes" are deleted.

35. Comments/Engineering Notes
Any comments or information notes that pertain to the aircraft condition or performance covered by the present or previous log pages may be entered by the flight crew.

Requests for information or comments pertaining to other areas of Technical Services responsibility should be made on the detachable forms provided in the back of the log book.

When a functional check of a system is required, following maintenance repair, and the flight crew accomplishes the check at the request of maintenance personnel, enter an Engineering Note in the log book when the check is completed.

* * *

FORM M-75 (10-69)
PRINTED IN U.S.A.

TWA

4-ENGINE AIRCRAFT LOG

№636760

AIRWORTHINESS RELEASE (PER. G.P.&P.1-10-0) BY	MAINT. DONE	CAPTAIN	DOMICILE	FLT. NO.
LOG CHECKED (Foreman & Sm.)	STN. & DATE	1ST OFF.		CAPT. SIG.
		FLT. ENGR.		

LEG	STATION FROM	STATION TO	TAKE OFF GROSS WT.	TAKE OFF FUEL	T. O. TEMP	CAT. 2 CON	CAT. 2 RWY	LANDING WT.	FLIGHT (Z) TIME OUT	OFF	ON	IN	AIR TIME	OIL ADD QTS. 1	2	3	4
1						I / D	S / U		:	:	:	:	:				
2						I / D	S / U		:	:	:	:	:				
3						I / D	S / U		:	:	:	:	:				
4						I / D	S / U		:	:	:	:	:				
5						I / D	S / U		:	:	:	:	:				

MCIED	PRESS ALT.	GROSS WEIGHT	SAT	RAT	IAS	MACH	T/C RPM OR 747 PACK PRESS. L / C / R	BLEED VALVE D EXCEPT 1-747CLSD	ENTER OIL ADD TOTAL BELOW
XVARNA/									

LEG	EPR	N1	EGT	N2	F/F	TL POS.	OIL TEMP / 747 VAC. TMP	OIL PRESS / 747 O/PRESS	#1POS(D) #2POS(T) AVM	ENG CODE / FLT. REMK.	PLANE NO.
1											0 0
2											LOG PAGE NO. MO. / DAY (Z) / YR.
3											
4											–

FLIGHT CREWS (1) ALL BLOCKS WITHIN THE HEAVY BLACK LINES MUST HAVE AN ENTRY OR A "O" WHEN TIME PERMITS COMPLETION OF THIS PORTION.
(2) COMPLETE INSTRUCTIONS FOR FILLING OUT THIS LOG BOOK ARE LOCATED IN THE AIRCRAFT FLIGHT HANDBOOK.

FLIGHT REMARK CODE
1=F/F 4=EGT 7=OIL CONS.
2=N1 5=AVM 8=ENG. PERF.
3=N2 6=EPR 9=ENG. STALL

MCIEB	A	PLANE NUMBER	TOTAL DISTANCE	COMPASS USED	SPLIT	HIGH	NO 1 L.T.	NO 1 C.T. L/R	NO 2 L.T.	NO 2 C.T. L/R
NAVGAT/										–

	B	PLANE NUMBER	TERM. STA.	FLT DIR.	I.N.S. NO 1 LATITUDE N/S	I.N.S. NO 2 LATITUDE N/S	I.N.S. NO 3 LATITUDE N/S

I.N.S. ON TIME (Z)	TERM. GATE TIME (Z)	I.N.S. NO 1 LONGITUDE E/W	I.N.S. NO 2 LONGITUDE E/W	I.N.S. NO 3 LONGITUDE E/W
				–

ITEM	MALFUNCTION	WORK PERFORMED, STATION, DATE MECHANIC MAKING CORRECTION

1

A. AIRSPEED TERMS

1. V . . . . Airspeed
2. V_a . . . . Maneuvering Speed
3. V_1 . . . . Critical Engine Failure Speed
4. V_r . . . . Rotation
5. V_2 (1.2 x V_{sl}) . . . . . . Minimum Takeoff Climb Speed
6. V_d . . . . Maximum Design Dive Speed
7. V_e (EAS) . . . . Equivalent Airspeed
8. V_{le} . . . . .Landing Gear Extended
9. V_{lo} . . . . .Landing Gear Operation Limit also, - Takeoff Lift Off Speed
10. V_{mca} . . . . .Minimum Air Control Speed (One Outboard Out)
11. V_{mc2} . . . . .Minimum Air Control - 2 Engine Out
12. V_{mcg} . . . . .Minimum Ground Control Speed (One Outboard Out)
13. V_{mu} . . . . Minimum Unstick Speed
14. V_{mo} . . . . Velocity Maximum Operating
15. V_s . . . . Stall Speed
16. V_{sl} . . . . .Stall Speed for Specified Flap Setting
17. V_{so} . . . . Stall Speed for Landing Flaps
18. 1.3 V_{so} . . . . Boundary or Over the Fence
19. REF. . . . . V_2 or 1.3 V_{so}
20. IAS . . . . .Indicated Airspeed
21. CAS . . . . Calibrated Airspeed
22. EAS . . . . .Equivalent Airspeed
23. TAS . . . . .True Airspeed
24. G.S. . . . . .Ground Speed
25. MSC . . . . Maximum Speed Cruise
26. LRC . . . . Long Range Cruise
27. MRC . . . . Maximum Range Cruise

B. MACH TERMS

1. M . . . . .Mach Number
2. M_{crit} (M_{cr}) . . . . Critical Mach Number
3. M_{le} . . . . .Landing Gear Extended Limit
4. M_{lo} . . . . Landing Gear Operating Limit
5. M_{mo} . . . . Mach Maximum Operating
6. Δ . . . . Change

C. ENGINE TERMS

1. F_n . . . . Thrust
2. F/F. . . . . Fuel Flow
3. EPR . . . . .Engine Pressure Ratio (P_{t7}/P_{t2})
4. P_{t7} . . . . Total Engine Pressure Behind Turbines
5. P_{t2} . . . . Total Engine Pressure in Front of Compressors
6. N . . . . .Speed of Compressor
7. EGT . . . . .Exhaust Gas Temp. (Behind Turbines)
8. P_b . . . . Burner Pressure
9. CDP. . . . . .Compressor Discharge Pressure
10. CDT . . . . .Compressor Discharge Temperature
11. CIT. . . . . Compressor Inlet Total Temperature

D. MISCELLANEOUS TERMS

1. A/P. . . . . .Auto Pilot
2. C. . . . . Centigrade Temperature
3. DME . . . . Distance Measuring Equipment
4. F. . . . . Fahrenheit Temperature
5. KIFIS . . . . .Kollsman Integrated Flight Instrument System (Air Data System)
6. NAM (NM) . . . . . . Nautical Air Miles
7. P.A. . . . . Pressure Altitude (Set 29.92)
8. G.W. . . . . .Gross Weight
9. MGL. . . . . .Maximum Gross Load
10. T.O. G.W. . . . . . .Takeoff Gross Weight
11. NAM/LB (NM/LB). . Nautical Air Miles Per Pound of Fuel
12. NGM/LB. . . . . . . Nautical Ground Miles Per Pound of Fuel
13. SAT (OAT). . . . . . Static (True) Air Temperature
14. SCAT . . . . .Speed Command Attitude Target
15. RAT. . . . . Ram (Indicated) Air Temperature
16. TAT. . . . . .Total (Ram Indicated) Air Temp
17. n(g). . . . . Acceleration Load Factor in Gusts and/or Maneuvers
18. CTR. . . . . .Center
19. RW . . . . Runway

). MISCELLANEOUS TERMS

- !0. FPI . . . . Flight Path Indicator
- !1. HDI . . . . Horizon Director Indicator
- !2. RMI . . . . Radio Magnetic Indicator
- !3. OBI . . . . Omni Bearing Indicator
- !4. T/C . . . . Turbocompressor (Cabin Air Compressor)
- !5. V/C . . . . Vapor Cycle System
- !6. KW. . . . . Kilo-Watts - Real Power
- !7. KVAR. . . . . Kilo-Volt Amperes (Reactive Power)
- !8. KVA. . . . . Kilo-Volt Amperes (Apparent Power)
- !9. Ø . . . . Electrical Phase

* * *

* * *

MINIMUM EQUIPMENT LIST (MEL)

The Minimum Equipment List is to be used for determining those items of normal equipment complement which may be inoperative for flight dispatch without adversely affecting the airworthiness of the aircraft.

All items of equipment which are related to the airworthiness of the aircraft and are not included in the list are required to be operative.

Such equipment obviously basic to the airworthiness of the airplane are tires, flight controls, engines, etc., and do not appear in the MEL.

Equipment having no airworthiness connotation such as passenger convenience and entertainment items are also excluded from the MEL, and are not required for flight.

Equipment not required for the flight to be conducted need not be operative.

Whenever the captain and dispatcher are unable to determine in which category an unlisted item belongs or in the event clarification as to the status of a listed item which may be only partially inoperative, etc., is desired, the captain and/or dispatcher should contact Operational Planning. Operational Planning will then contact the appropriate Flight Operations staff personnel for an interpretation of the condition. A confirming teletype message will than be sent to all parties concerned. However, the flight should not be delayed awaiting this confirming message since it will become a part of the flight records.

The captain and the dispatcher are responsible only to determine that the flight in question can be conducted safely under the flight conditions anticipated using the appropriate MEL; however:

Under no condition shall a flight be operated with less operative equipment than that required by the MEL.

The captain may require equipment to be operative over and above the minimum specified in the MEL when in his judgment such equipment is needed for the conditions under which the flight is to be conducted.

When multiple permissible inoperative items exist, the captain will assure that any interface or inter-relationship between inoperative systems or components, or the exposure to additional failures, will not result in a degradation in the level of safety and/or undue increase in crew workload.

For the purpose of this regulation the following definitions shall apply:

VFR conditions are considered to exist when:

Airport ceiling and visibility are forecast and reported at all times at least 1000 feet above the initial approach altitude and three miles, and

En route operation from point of takeoff to point of landing can be conducted with visual ground contact.

All other operating conditions shall be considered IFR.

NOTE

Under special circumstances specific test or ferry flights may be conducted with inoperative equipment beyond that allowed by this list upon specific authorization by NYCWO.

PLACARDING POLICY

Maintenance policy provides for a standard procedure governing temporary cockpit placarding of inoperative or malfunctioning equipment.

In the upper portion of the placard the appropriate maintenance agency enters airplane number, station, logbook pages involved, and description of malfunction or deactivation. This portion is attached to outside front cover of the logbook.

The lower section of the placard is a tear-off containing the words, "INOPERATIVE" and "MALFUNCTIONING." The portion containing the appropriate word is applied on or adjacent to the affected instrument or control.

When corrections are made, both sections of the placard are to be removed.

NOTE

Inoperative means any time a system and/or component malfunctions to the extent that it does not accomplish its intended purpose and/or is not consistently functioning within its designed operating limit(s) or tolerance(s).

MINIMUM EQUIPMENT LIST	880 NORMAL COMPLEMENT	880 PERMISSIBLE INOPERATIVE	REMARKS
R CONDITIONING			
Freon Packs	2	1*	
Automatic cabin pressure controller	1	1*	
Manual cabin pressure control	1	A*	A. May be inoperative for unpressurized flight.
Cabin temp. control systems	2	B*	B. Either Auto or Manual control may be inoperative.
Cockpit temp. control systems	2	B*	
Cabin airflow Inds.	2	2*	
Cabin rate-of-climb indicator	1	C*	C. May be inoperative provided all other instruments and functions of pressurization system operate normally.
Electric heaters	2	2	
Condenser ground cooling shutoff	2	D*	D. One may be inoperative provided valve is secured closed and that refrigerator not operated on the ground, and at speeds below 185 knots in flight.
Condenser cooling fan	2	D*	
Condenser cooling air modulation valve	2	E*	E. One may be inoperative. If open do not operate that refrigerator on ground; if closed do not operate that refrigerator in flight.
Alternate press. source valve	2	F*	F. May be inoperative for unpressurized flight. For pressurized flight either one T/C or one alternate pressure source valve may be inoperative provided the electronic cooling fan and valve are operative if the T/C inoperative.
Turbocompressor	2	F*	
Outflow valves	2	G*	G. One may be inoperative provided it is electrically positioned closed and emergency relief function of that valve remains operative.
Ram air shutoff valve	2	H*	H. Valve(s) may be failed open for unpressurized flight. For pressurized flight, valve(s) may be failed closed provided at least two air sources and both freon packs are functioning normally.
Recirculating fan	1	1*	
Recirculating fan shutoff valve	1	J*	J. May be inoperative in closed position if fan not operated.
Cabin altimeter	1	K*	K. Either the cabin altimeter or differential pressure gauge may be inoperative.

* Inoperative unit must be appropriately placarded in the cockpit.

MINIMUM EQUIPMENT LIST	880 NORMAL COMPLEMENT	880 PERMISSIBLE INOPERATIVE	REMARKS
s. Cabin differential pressure gauge	1	K*	
t. T/C bearing temp. ind. (if installed)	2	2*	
u. Cabin altitude warning system	1	L*	L. May be inoperative provided flight not operated above 10,000 feet.
v. Cabin temp. ind. system	1	1*	
w. Duct temp. ind. systems	4	4*	
AUTOPILOT AND CONTROL SYSTEMS			
a. Autopilot	1	A*	A. Autopilot approach coupler must be operative if weather at destination airport forecast to be Category II conditions; or if forecast to be less than 1 mile visibility (RVR 5000), <u>and</u> No. 1 flight director system is inoperative.
b. Autopilot trim ind.	1	B*	B. May be inoperative if autopilot not engaged. If rudder axis of trim indicator inoperative yaw damper shall not be engaged.
c. Elevator out-of trim light	1	B*	
d. Control wheel autopilot disconnect buttons	2	C*	C. One may be inoperative provided autopilot disengaged below 10,000 MSL.
e. Autopilot glide slope annunicator	1	D*	D. May be inoperative provided autopilot not used for coupled approach.
f. Autopilot Loc. annunicator	1	D*	
g. Autopilot auto capture button	1	1*	
h. Yaw Damper	1	1*	
i. Speed stability systems	1	E*	E. May be inoperative provided following speed limitations observed: Normal operation - 333 IAS - .725 M_i Emergency descent only - 373 IAS - .775 M_i
j. Stabilizer trim systems	3	F*	F. Electric standby system may be inoperative.
k. Wing flap position ind.	2	G*	G. One needle may be inoperative provided a crew member visually checks position prior to takeoff.
l. Warning horn (take off function only)	1	H*	H. May be inoperative. Do <u>not</u> deactivate circuit breaker.
m. Vortex generators	98	J	J. A total of 6 may be missing from wings provided no more than 4 missing from one side. A total of 8 may be missing from the fin provided no more than 4 missing from one side.

* Inoperative unit must be appropriately placarded in the cockpit.

MINIMUM EQUIPMENT LIST	880 NORMAL COMPLEMENT	880 PERMISSIBLE INOPERATIVE	REMARKS
COMMUNICATIONS			
a. Selcal System	2	2*	
b. Service Interphone System	1	1*	
c. Cockpit Speaker Systems	2	2*	
d. Electronics Compt. Cooling System	1	A*	A. Either the cooling fan or cooling valve may be inoperative provided at least one T/C and one alternate air source operative.
e. Hostess Call System	1	B	B. May be inoperative. If cockpit to cabin call system inoperative, both the P.A. system and cabin interphone must be operative.
f. P.A. System	1	C*	C. May be inoperative for a flight or series of flights but may not depart a station where repair or replacements can be made. Required passenger oxygen and emergency briefing must be conducted orally, and hostess interphone system operative.
g. Hostess Interphone System	1	D*	D. May be inoperative provided P.A. system is operative.
h. Flight Deck Interphone System	4	E	E. Required for all crew members on flight deck duty.
ELECTRICAL POWER			
a. Generator systems	4	A*	A. One may be inoperative provided the bus tie system is operative.
b. Watt-Var meters	4	B*	B. Any watt-var meters may be inoperative provided corresponding ammeters are functioning normally.
c. Ammeter	4	C*	C. Any ammeters may be inoperative provided the corresponding watt-var meters are functioning normally.
d. Transformer rectifier unit	4	1*	
e. A.C. Essential power selector	1	D*	D. May be inoperative in one generator position provided 4 generators are operating normally.
FUEL SYSTEM			
a. Refueling panel quantity gauge systems	4	4*	
b. Fuel totalizer ind.	1	1*	
c. Fuel boost pumps	8	A*	A. One may be inoperative per tank.
d. Fuel transfer and replenish pumps	8	B*	B. Any pump and/or light or combination of pumps and/or lights may be inoperative, provided: 1. Fuel use management monitored to remain within C.G. limits.
			* Inoperative unit must be appropriately placarded in the cockpit.

MINIMUM EQUIPMENT LIST	880 NORMAL COMPLEMENT	880 PERMISSIBLE INOPERATIVE	REMARKS
			2. When total fuel onboard is less than 6000# or there is less than 1500# in a tank with an inoperative pump or light, then crossfeed corresponding engine(s) with adjacent tank on same side. Do not shut off affected tank.
e. Fuel transfer and replenish pump low pressure lights	8	B*	
f. Fuel jettison pumps	4	C*	C. #2 and #3 may be inoperative provided respective scavenge pumps are operative. Any may be inoperative if takeoff weight does not exceed 162,500#. (105% max. landing wt.)
g. Fuel scavenge pumps	2	2*	
h. Boost pump low pressure lights	8	D*	D. One per tank may be inoperative provided other boost pump in that tank is operative.
i. Fuel temp. indication	5	E*	E. May be inoperative in tank and one engine position.
j. Engine fuel pump warning lights	4	F*	F. May be inoperative provided respective fuel tank boost pumps and warning lights are operative.
k. Low level float switches	6	G*	G. May be inoperative provided respective pump considered inoperative and restrictions under remark "B" observed.
l. Refuel pre-check systems	4	4*	
m. De-fuel valves	2	H*	H. May be inoperative if valve secured closed.
n. De-fuel valve lights	2	H*	
o. Fuel valve in-transit lights	10	J*	J. May be inoperative provided respective valve physically checked for normal operation prior to takeoff.
p. Fuel quantity gauges	4	K*	K. One may be inoperative provided fuel quantity in subject tank ascertained by drip stick and in flight fuel consumption computed by fuel flow integration, all per instructions in Chapter 02, of 880 Flight Handbook.
q. Pressure refueling system	4	4	
r. Crossfeed valves	6	L*	L. One may be inoperative provided it is fixed in open position.
s. Fuel heaters	4	M*	M. May be inoperative provided airplane operated to maintain engine fuel temperature 0°C or above.
HYDRAULIC SYSTEM			
a. Auxiliary hydraulic pump	1	1*	

* Inoperative unit must be appropriately placarded in the cockpit.

MINIMUM EQUIPMENT LIST	880 NORMAL COMPLEMENT	880 PERMISSIBLE INOPERATIVE	REMARKS
b. Nose wheel brake systems	1	A*	A. May be inoperative provided system is disarmed and the appropriate takeoff and landing restrictions, as found in chapter 15 of the flight handbook, are adhered to. Revised release should be provided if malfunction known prior to actual flight departure. (Place "nose wheel brakes" switch off. Do not deactivate NLG anti-skid circuit breaker.)
c. Air brake line test pressure gauge	1	1*	
d. Engine driven pump low pressure warning lights	4	B*	B. One in each system (#1 and #2) may be inoperative provided respective pump determined to be operating normally prior to takeoff and landing by deactivating pump with operative light and noting pressure depletion and buildup on pressure gauge. Pump with operative light must be on at all times except for check.
e. Engine driven pump depressurizing systems	4	C*	C. May be inoperative provided supply line shutoff valve operative.
f. System supply pressure low warning light	2	2*	
g. Main gear anti-skid inoperative light	1	D*	D. "Inoperative" light may be inoperative provided all "release" lights operative. Any "release" lights may be inoperative provided "inoperative" light is operative.
h. Main gear anti-skid release lights	8	D*	
i. Parking brake systems	1	E*	E. Must be operative for flight origination. May be inoperative departing a through station only if correction cannot be made by component replacement from available stock or by reasonable maintenance effort. (The intent of this regulation is to make all reasonable effort to maintain this component operative at all times within the bounds of avoiding extensive flight delay or cancellation.)
j. Main landing gear truck unlevel light	1	F*	F. May be inoperative. When dispatching with inoperative light, locked lever must not be overridden unless greater emergency exists.
k. Hydraulic system fluid quantity gauges (cockpit and hydraulic compartment)	3	G	G. Hydraulic reservoir sight gauge may be inoperative provided an alternate positive method of determining the fluid quantity is utilized. Tank #2 hydraulic quantity indicator may be inoperative provided: 1. The tank #1 hydraulic quantity indicator is operative. 2. The hydraulic reservoir sight gauge is operative. 3. The tank #1 indicator is monitored closely for any indication of a fluid loss. 4. Both low pressure warning lights for the #2 system are operative.
ICE AND RAIN PROTECTION			
a. NESA windshield systems	1	A*	A. 1. Anti-fog for 4 aft windows may be inoperative. 2. Anti-fog on captain's or first officer's windshield may be inoperative provided anti-ice and rainclear operative on that windshield. Center windshield anti-fog may be inoperative provided anti-ice operative. 3. Anti-ice for 3 forward windshields may be inoperative for flight into non-icing conditions provided anti-fog and rainclear operative. 4. Anti-ice for captain's or first officer's windshield may be inoperative for flight into icing conditions provided anti-fog and rainclear are operative on affected windshield.

* Inoperative unit must be appropriately placarded in the cockpit.

MINIMUM EQUIPMENT LIST	880 NORMAL COMPLEMENT	PERMISSIBLE INOPERATIVE	REMARKS
7. Ice and Rain Protection			
b. Pitot heaters	2	B	B. Captain's may be inoperative provided flight not conducted in visible moisture or icing conditions.
c. Rain clear system	1	C	C. May be inoperative if no precipitation anticipated in departure or arrival terminal areas; further, provided that if any NESA windshield system is inoperative the provisions of Remark "B" above are also met. (Rainclear shutoff valve must be operative at all times.)
d. Wing anti-ice systems	2	D*	D. Left and/ or right wing systems may be inoperative for flight into non-icing conditions, provided inoperative valves remain closed.
e. Wing anti-ice valve lights	6	6*	
f. Anti-ice ON advisory light	1	1*	
g. Engine anti-ice systems	4	E*	E. One anti-ice valve (front frame or duct lip) on one engine may be inoperative provided flight not operated in icing conditions and valve is in closed position.
h. SCAT lift transducer heater (if installed)	1	1*	
i. Rain repellent systems	1	1*	
j. Static Port Heaters	2	F*	F. Static port heaters may be inoperative, provided if any heater inoperative and conditions of moderate to heavy precipitation exists in landing terminal area: 1. The approach and landing must be conducted with an operable ILS including glide slope to utilize published ILS minima. 2. For any other approach except circling, limits are 800-2 unless published limits are higher. For circling, at least 1000-3 required.
8. Lights			
a. Navigation lights	3	A	A. May be inoperative for DAY conditions. One lamp in each position may be inoperative.
b. Taxi lights	2	2*	
c. Landing lights	4	B*	B. None required for DAY operation. For NIGHT operation, one light on each side may be inoperative.
d. Anti-collision lights	2	C*	C. One may be inoperative for DAY conditions.
e. Wing illumination lights	2	2*	
f. Instrument panel, pedestal, and consol lighting systems	D	D*	D. Components of these lighting systems may be inoperative provided sufficient illumination is available to make all controls and instrumentation easily readable for safety of flight by remaining lighting.
g. Cockpit red dome light	2	2*	
h. Map lights	2	2*	
i. Cabin lighting system (normal)	E	E*	E. Any may be inoperative (except emergency lights), providing remaining illumination adequate for performance of Cabin Attendant duties.
j. Cargo compt. lighting systems	2	2	

* Inoperative unit must be appropriately placarded in the cockpit.

INIMUM
QUIPMENT LIST

MINIMUM EQUIPMENT LIST	880 NORMAL COMPLEMENT	880 PERMISSIBLE INOPERATIVE	REMARKS
IGHTS			
. Wheel well lights	3	3	
Seat belt - no smoking sign system	1	F*	F. May be inoperative provided: 1. Cockpit-cabin call and interphone systems are operative. 2. P. A. system is operative and used to announce seat belt and no smoking restricitions.
ı. Emergency exterior lights & Slide light system	1	G*	G. These lights may be inoperative on all aircraft provided flight originations and terminations are within daylight hours. Manual revisions follow.
AVIGATION			
. Remote compass systems	2	A*	A. One system may be inoperative for VFR conditions provided one heading indication is operable on each Pilot's panel. One system may be uncompensated for VFR or IFR. Both systems may be uncompensated for one flight under VFR conditions.
. Magnetic compass	1	B*	B. Must be operative at flight origination. If inoperative en route flight may continue to termination. Both polar path compass systems must be operative.
. ADF receivers	2	1*	
. Clocks	3	1	
. Flight director systems (command bar)	2	C*	C. One system may be inoperative if weather conditions at the destination airport are forecast to be one mile visibility (5000 RVR) or better. If forecast less than one mile (5000 RVR), No. 1 flight director system may be inoperative, provided No. 2 system including display on both Pilot's panels is operative and the autopilot approach coupler is operative. If Category II weather conditions forecast for destination airport, both flight director systems must be operative for dispatch.
. Flight recorder	1	D*	D. In the event of malfunctioning or failure of the flight or voice recorder, the airplane may continue the flight or series of flights, but may not depart a station where repairs or replacements can be made. The flight recorder beep tone may be inoperative.
;. Voice recorder	1	D*	
ı. Mach/Airspeed warning system	1	E*	E. May be inoperative provided both machmeters operative and speed stability inoperative speed limitations are observed. NOTE: If warning sounds below speed stability inoperative limit speeds pull the circuit breaker. If warning sounds above speed stability inoperative limit speeds, operate below warning onset and do not deactivate the warning.
			* Inoperative unit must be appropriately placarded in the cockpit.

EQUIPMENT ITEM	880 NORMAL COMPLEMENT	880 PERMISSIBLE INOPERATIVE	REMARKS
9. Navigation			
i. Glide slope system	2	EE*	EE. One may be inoperative provided weather at destination forecast to remain at or above 200 - 1/2 or RVR 2400.
j. KIFIS system	2	F*	F. One KIFIS system may be inoperative provided circuit breaker pulled. If captain's KIFIS system is inoperative then speed stability inoperative limitations must be observed. If a malfunction or failure occurs to the captain's KIFIS system airplane may continue the flight or series of flights, but may not depart a station where repairs or replacements can be made.
k. Machmeter	2	G*	G. One may be inoperative. If captain's inoperative observe speed stability inoperative limitations.
l. Marker beacon systems	1	H*	H. May be inoperative for VFR conditions, or may be inoperative for IFR conditions provided both ADF's operative and weather at destination forecast to remain at or above 250-3/4 or 4000 RVR.
m. Static air temp. ind.	1	J*	J. Either the static air temperature indicator or ram air temperature indicator may be inoperative.
n. Ram air temp. ind.	1	J*	
o. True airspeed ind.	1	1*	
p. Slip Indicators	2	0	
q. RMI	2	L*	L. One RMI may be inoperative in all functions provided the compass card and ADF pointer indication operate in the other RMI. The VOR pointer indication may be inoperative in both RMIs.
r. Omni-bearing ind.	2	2*	
s. Altimeter vibrator	2	M*	M. One may be inoperative provided terminal VFR conditions exist at departing and arriving stations.
t. Weather radar systems	1	N*	N. May be inoperative: 1. Under DAY VFR conditions. 2. Under NIGHT VFR or under IFR conditions provided current weather reports indicate no thunderstorms or other potentially hazardous weather conditions which can be detected by weather radar exist en route. 3. At through stations when current weather reports indicate thunderstorms or other potentially hazardous weather conditions which can be detected by weather radar do exist en route provided the captain: a. Reviews the Company Jet Route Selection Advisory Forecast. b. Reviews latest available weather report and flash advisories. c. Receives from Dispatch any information deemed significant regarding thunderstorms or other hazardous weather conditions. d. Plans flight to select routes or altitudes which will avoid forecast hazardous thunderstorms en route whenever feasible.

*Inoperative unit must be appropriately placarded in the cockpit.

MUM
IPMENT LIST

EQUIPMENT ITEM	880 NORMAL COMPLEMENT	880 PERMISSIBLE INOPERATIVE	REMARKS
Navigation			
t. Weather radar systems (cont'd)			4. On any training, test, or ferry flight. Dispatch Release It will be necessary to include in the dispatch release this statement, "Airborne weather radar not operative and not required", whenever the captain and flight dispatcher are advised by maintenance that the airborne weather radar is inoperative and it is determined by the captain and the dispatcher that this facility is not required for the particular weather conditions. The captain is responsible to assure entry is made on the dispatch release form at the station if not already included in the dispatch release message or supplement.
u. DME system	2	1*	
v. SCAT system	1	P*	P. If installed, may be inoperative for dispatch unless weather at destination airport forecast to be Category II conditions.
w. Autothrust system	1	P*	
x. ATC transponder	2	Q*	Q. One must be operative at flight origination. In the event both ATC transponders become inoperative en route the flight may continue to the next point of intended landing where repairs or replacement facilities are available. Appropriate authorization from the ATC Centers concerned is necessary.
y. Altitude Encoder	2	2*	
z. Compass Comparator system	1	1*	
a. Radio Altimeter (If installed)	1	1*	
b. Altitude Alerting System	1	R*	R. In the event of malfunction or failure, the airplane may continue the flight or series of flights but may not depart a station where repairs or replacements can be made.
c. Standby Horizon Indicator	1	0	
Power Plant			
a. EPR Indicators	4	A*	A. One EPR may be inoperative provided affected engine has operative fuel flow indication and the following apply: 1. An engine with inoperative EPR, all other thrust related indications, namely RPM, EGT and Fuel Flow were normal on last flight leg. 2. Prior to each takeoff a visual check of the engine (inlet and exhaust) with the inoperative EPR will be made. 3. Observe alternate takeoff procedures outlined in Flight Handbook. 4. Maintenance: See GP&P chapter/section 4-5-1 page 8B for special Maintenance responsibility and procedures.
b. Fuel Flow Indicators	4	B*	B. One may be inoperative provided respective main tank quantity gauge is operative.
c. Thrust reversers	4	C*	C. One may be inoperative, or one on each side provided they are symmetrically opposite, provided reverser(s) is in stowed position, and runways at takeoff and landing airports are forecast to be clean and dry if less than 7500' in length.

* Inoperative unit must be appropriately placarded in the cockpit.

MINIMUM EQUIPMENT LIST	880 NORMAL COMPLEMENT	880 PERMISSIBLE INOPERATIVE	REMARKS
10. Power Plant			
d. Reverse thrust position lights	4	D*	D. May be inoperative if reverser inoperative. Either the position or the in-transit light may be inoperative for operating reversers.
e. Reverse thrust in-transit lights	4	D*	
f. Engine bleed valves	4	E*	E. One may be inoperative for operation in non-icing conditions provided valve is closed and air bleed limits in Section I of 880 Flight Handbook observed. If bleed air valve light inoperative assume valve inoperative and leave in closed position.
g. Oil quantity gauges	4	F*	F. One may be inoperative provided respective oil tank serviced to capacity and it is determined no oil leaks exist.
h. Oil low pressure lights	4	G*	G. One may be inoperative provided respective oil quantity gauge operative.
i. EPR settable index	4	H	H. Any may be inoperative provided alternate takeoff procedure (set takeoff thrust prior to brake release), as outlined in Flight Handbook is used.
j. Start Valve position lights	4	J*	J. May be inoperative provided: 1. No crossbleed starts permitted. 2. Start all engines with bleed valves closed. 3. Compare start cart duct pressure after all engines started to before starting pressure to insure all start valves closed.
k. Engine vibration monitor systems	4	4*	
l. Igniters	8	K*	K. One may be inoperative provided anti-ice system fully operative on that engine.
11. Miscellaneous			
a. Door warning systems	2	A*	A. Any door warning light system may be inoperative providing: 1. The malfunction is definitely isolated to the door warning light system. 2. A functional check of the door and latching mechanism is performed to assure proper door operation. 3. Door handles are checked on exterior and interior (when possible) by crew and maintenance to insure handles are in the "closed" and "locked" position.

* Inoperative unit must be appropriately placarded in the cockpit.

EQUIPMENT ITEM	880 NORMAL COMPLEMENT	880 PERMISSIBLE INOPERATIVE	REMARKS
1. Miscellaneous			
b. Rigid static discharger	B	B	B. Aircraft equipped with rigid static dischargers may be dispatched with any number missing. Replacement will be made at next check "C".
c. Portable O_2 bottles in cabin	6	C	C. One serviceable bottle must be available in the cabin for each operating Cabin Attendant.
→ d. Crew and Passenger Oxygen Systems	2	D*	D. Supplemental oxygen not required for passengers on flights below FL 100.
e. Engine fire extinguisher bottle discharge lights	4	4	
f. Megaphone	1	E*	E. Must be operative for flight origination. May be inoperative departing a through station only if correction cannot be made by component replacement from available stock or by reasonable maintenance effort. (The intent of this regulation is to make all reasonable effort to maintain this component operative at all times within the bounds of avoiding extensive flight delay or cancellation.)
g. Evac signalling system (if installed)	1	F*	F. May be inoperative provided each panel placarded and all cockpit and cabin crew members advised of status.
h. Crew life vests	5	G*	G. ACM life vest(s) may be missing for each ACM seat not occupied. All occupied cockpit seats must have serviceable life vest stowed in designated location.
i. Flight deck shoulder harness		H*	H. Out of stations where repairs or replacements can be made, the pilot's co-pilots and flight engineer's seats shall each have an operative shoulder harness.

* * *

*Inoperative unit must be appropriately placarded in the cockpit.

A. GENERAL

Charts include thrust setting for Takeoff, Climb (Max. Cont.), Constant Mach, Long Range, and Maximum Range/Holding cruise. Performance charts are for Climb, Constant Mach, Long Range and Max. Range/ Hold cruise configurations.

B. TAKEOFF THRUST SETTING

1. Opposite existing ambient temperature and under the appropriate station pressure read EPR required and expected RPM.

2. Maximum RPM limit is given opposite the ambient temperature and EGT limits as a footnote.

3. Engine bleed effects on EGT are noted as a guide to engine condition, and to show EGT decrease available by closing bleed valve in event engine operates at EGT limit.

C. CLIMB THRUST SETTING (Max Continuous Thrust)

This chart presents climb (max. cont.) thrust as EPR for any indicated RAT and RPM for any combination of indicated RAT and altitude.

D. CRUISE THRUST SETTING

1. Normal Cruise Thrust Setting Chart.
This chart presents the basic thrust setting parameters required to achieve the Minimum Cost speed schedule cruise configuration (M. 82) for any combination of gross weight and flight level.

   a. At intersection of cruising flight level and airplane gross weight and given IAS required for Min. Cost speed schedule, average EPR required to maintain speed, and limiting temperatures (RAT and OAT at Min. Cost Mach) at which that EPR equals Max. Cruise Thrust.

   b. If OAT at the desired flight level (or RAT when at Min. Cost speed) is equal to or less than values shown in appropriate thrust setting block, accelerate to Min. Cost IAS and set EPR given.

   If existing OAT or RAT is higher than values in block, set EPR by Max. Cruise Thrust Table and accept resulting cruise speed.

   c. Buffet guidance is provided for 1.5 and 1.3G maneuver margins at the weight-altitude described by the designated boundary lines. Operation at or below the 1.5G line will provide sufficient maneuvering margin for protection from unanticipated severe convection turbulence. The area between 1.5 and 1.3G lines will accommodate all clear air turbulence and light to moderate turbulence associated with thunderstorm activity. Operation above the 1.3G line should be conducted only if smooth air is anticipated.

2. Long Range Cruise Thrust Setting and Max. Range/ Hold Cruise Thrust Setting Charts.
These charts present the basic thrust setting parameters required to maintain the desired speed for that cruise configuration for each combination of altitude and gross weight. Included are the temperatures at which that EPR equals the max. cruise thrust rating. Use of the charts is as explained for the normal cruise thrust setting chart in paragraphs D.1.a and b.

E. MINIMUM COST ALTITUDE/WIND TRADE

The minimum cost altitude/ wind trade chart provides a means of determining the minimum cost altitude for a flight segment as a function of weight and differential wind component. The solid line labeled Reference Optimum Altitude represents the optimum cost altitude for a zero wind gradient condition (the same wind at all altitudes). The light lines labeled Compensating Wind Required represent the additional wing component required to justify flying at other than reference altitude.

This chart takes into account all the variables that affect costs. When the speed is optimized as it is when flying at minimum cost mach, the other factors of weight and wind will determine the altitude where the aircraft should operate for minimum cost. The wind lines show the wind additives from the reference altitude where the cost of operating the aircraft would be identical. This takes into account the change in TAS and fuel flow at the various altitudes.

The relationship of weight, altitude and wind effect on minimum cost will continually change, as the flight progresses. Therefore, these variables should be periodically assessed to assure the aircraft is being operated at the best altitude.

F. CLIMB CHARTS

1. The values in these charts are expected performance based upon the following parameters.

   a. The weight index is that at brake release.

   b. Static Air Temperature (SAT) references the performance data block for the climb to the altitude in which column it appears. SAT = OAT.

   c. "Fuel" and "Time" are those required from brake release to acceleration to cruise speed at top of climb. "Distance" is the still air nautical ground miles covered during this period.

   d. "AVG. TAS" is the average value during climb.

   e. The values in this chart are based upon a 350 KIAS/ M.80 climb schedule.

2. The aircraft initial cruising capabilities at the top of climb are denoted by the background treatment of each climb performance block as follows:

   a. Shaded area indicates aircraft has Long Range Cruise capabilities for altitude-weight-temperature conditions in this envelope.

   b. Unshaded portion of chart denotes aircraft has at least M.82 capabilities for the altitude-weight-temperature conditions as shown.

   c. Black dot in box indicates cruise speed may be limited by V_{mo} restriction.

3. Use of Charts

   a. Select climb chart for the appropriate takeoff weight. (Start of roll weight.)

   b. Opposite the selected cruising altitude find the column headed by the forecast temperature for that altitude.

F. **CLIMB CHARTS** (Cont'd)

c. Read the expected "Dist-Fuel-Time-and AVG TAS" climb performance.

d. Note the aircraft initial cruise capability for the selected condition.

G. **CRUISE CHARTS**

Tabularized charts are provided for the following cruising regimes:

a. Mach. 82 Cruise
The speed schedule resulting in maximum operating economy.

b. Long Range Cruise
The speed schedule which will produce 99% of the maximum range for the flight condition. (1% range is sacrificed for 4-6% gain in speed.)

c. Maximum Range/ Hold
A speed schedule which provides maximum endurance without loss in range over LRC and is also maximum endurance in the clean configuration for racetrack holding patterns. This schedules the minimum thrust possible at a sacrifice of no more than 1% of aircraft maximum range capability and schedules a speed no less than 1.1 minimum drag speed (True max. endurance in level flight.) The 10% speed margin compensates for the "G" loading experienced in turns and prevents dropping below V_{md} and the necessity of adding power during the turn.

d. Maximum Cruise Thrust Setting
This chart references maximum cruise thrust as EPR versus indicated RAT.

2. All performance values shown in these charts are instantaneous values for the altitude-temperature-weight combination selected.

3. Shaded area indicates speed is less than M. 82 on the M. 82 Charts, and less than long range cruise speed on the LRC Charts due to thrust limitations. All performance data shown in this area is at Maximum Cruise Thrust.

4. Fuel flow shown on chart assumes normal engine bleeds.

5. Temperature values on the cruise charts are OAT and indicated RAT. OAT is found on the Temperature Conversion Chart for any combination of indicated RAT and Mach. OAT may also be derived from indicated SAT by applying the following correction:

	Indicated Mach			
OAT = Indicated SAT -	.3	.5	.7	.9
	-4°	-5°	-6°	-7°

Chart Mach values are indicated Mach.

To correct temperature and speed indications for instrument error (calibration) in order to crosscheck instrument accuracies on the Jeppesen Computer apply the following factors: (for normal cruise conditions)

True Mach = Indicated Mach + .005
CAS = IAS + 2 KTS.

On the computer align pressure altitude with calibrated airspeed and read true mach number. Set .9 recovery factor line on cursor at indicated RAT and read true airspeed.

8. EPR (A/ L) is presented in each performance block as the (A) average setting required on all 4 engines to obtain that performance, followed by (L) the maximum cruise thrust limit EPR for that Mach number.

9. The code letter "B" is inserted in certain high weight-high altitude performance blocks to denote that in this configuration the aircraft will experience buffet at turbulence penetration speed should gust loads of 1.5Gs be exceeded.

10. Use of Charts: PARA. 2

a. Select cruise chart for the appropriate cruise regime and altitude.

b. Locate the performance block intersecting the OAT at that altitude and aircraft instantaneous gross weight.

c. Interpolate between temperature columns as required.

d. The performance values shown are those which the aircraft should produce for conditions selected.

e. Proceed to the next lower weight bracket when aircraft weight has been reduced to that value.

f. When flying at maximum cruise thrust, if aircraft is substantially below chart speed, EPR may be increased .01 for each .01 low in Mach. When flying at a constant Mach, LRC, or MRC/HOLD, schedule at less than maximum cruise thrust; if aircraft is below chart speed, EPR may be increased as required to obtain chart speed. In this case do not exceed maximum cruise thrust EPR for that Mach number as shown in that performance block.

IMPORTANT
Fleet consistency of performance is very high. Before deviating from chart EPR as provided above make every effort to determine accuracy of speed, temperature, and thrust instrumentation and weight calculation. If necessary to deviate from EPR to obtain chart speed make corresponding log write-up.

g. When aircraft speed falls below chart value because of turbulence, maneuvering, etc., set maximum cruise thrust limit EPR to accelerate back to chart speed; then reset chart EPR. When speed is reduced substantially below chart for turbulence penetration, etc., set maximum continuous thrust limit EPR to accelerate back to chart speed; then reset chart EPR.

h. Whenever ATC or weather restrictions dictate operating at an altitude where the performance chart is blank for the temperature and aircraft weight combination the following shall be observed:

(1) Set EPR shown in the warmest temperature block for the aircraft weight.
(2) Aircraft Mach and IAS and RAT should be that shown in the above specified block. Other given performance values will deviate, but may be estimated by noting difference in shown performance values for same temperature spread at constant EPR.
(3) Check resulting thrust against Maximum Continuous Thrust Climb Table. DO NOT EXCEED MAXIMUM CONTINUOUS THRUST.

G. **CRUISE CHARTS**

(4) Enter in logbook at least one performance entry at this thrust and note duration of its use and brief statement of reason necessitating its use.

(5) Use of this provision shall be confined to those instances where no practical alternative in altitude or route exists.

NOTE

In no case shall any chart blank area be relied on for Flight Planning Purposes.

TRANS WORLD AIRLINES

CONVAIR 880

PLANNING & PERFORMANCE

CLIMB 185,000 LBS.

CLIMB 185,000 LBS.

SAMPLE

PRESSURE ALTITUDE	OPERATING PARAMETER	GROSS WEIGHT 185,000 LBS (T.O.G.W.)								
40,000	SAT - °C FUEL-LB TIME/DIST. AVG. TAS-KTS.									
39,000	SAT - °C FUEL-LB. TIME/DIST. AVG. TAS-KTS.									
37,000	SAT - °C FUEL-LB TIME/DIST. AVG. TAS-KTS.									
35,000	SAT - °C FUEL-LB TIME/DIST. AVG. TAS-KTS.	-70 8730 24/162 435	-65 9090 25/172 440	-60 9570 27/188 445	-55 10180 29/207 450	-50 10920 33/229 454				
33,000	SAT - °C FUEL-LB TIME/DIST. AVG. TAS-KTS.	-70 7750 19/130 429	-65 8030 20/138 434	-60 8420 22/148 439	-55 8910 24/162 443	-50 9480 26/179 448	-45 10080 29/198 454	-40 10910 32/225 459	-35 12080 36/263 464	
31,000	SAT - °C FUEL-LB TIME/DIST. AVG. TAS-KTS.	-65 7260 17/115 427	-60 7550 18/123 433	-55 7900 20/132 437	-50 8340 22/144 442	-45 8830 23/158 447	-40 9380 25/175 452	-35 10170 28/199 457	-30 11300 32/233 461	-25 12890 38/280 465
29,000	SAT - °C FUEL-LB TIME/DIST. AVG. TAS-KTS.	-60 6880 16/103 425	-55 7150 17/111 430	-50 7470 18/119 435	-45 7850 19/130 440	-40 8280 21/142 444	-35 8830 23/157 449	-30 9610 26/178 454	-25 10690 30/208 458	-20 12180 35/249 462
28,000	SAT - °C FUEL-LB TIME/DIST. AVG. TAS-KTS.	-60 6570 15/95 421	-55 6830 16/102 426	-50 7110 17/109 431	-45 7450 18/118 436	-40 7850 19/129 440	-35 8300 21/141 445	-30 8940 23/159 450	-25 9840 27/183 454	-20 11090 31/217 458
27,000	SAT - °C FUEL-LB TIME/DIST. AVG. TAS-KTS.	-55 6520 15/94 422	-50 6780 16/100 427	-45 7080 17/108 432	-40 7440 18/117 436	-35 7840 19/128 441	-30 8370 21/142 446	-25 9120 24/162 451	-20 10160 28/190 455	-15 11590 33/228 458
26,000	SAT - °C FUEL-LB TIME/DIST. AVG. TAS-KTS.	-55 6230 14/86 418	-50 6470 15/92 423	-45 6740 16/99 428	-40 7050 17/107 432	-35 7420 18/117 437	-30 7860 19/128 442	-25 8480 22/144 447	-20 9360 25/167 451	-15 10560 29/199 454
25,000	SAT - °C FUEL-LB TIME/DIST. AVG. TAS-KTS.	-55 5950 13/79 414	-50 6180 14/85 419	-45 6420 14/91 423	-40 6700 15/98 428	-35 7040 17/107 432	-30 7420 18/116 437	-25 7930 20/129 442	-20 8660 22/148 447	-15 9670 26/174 450
24,000	SAT - °C FUEL-LB TIME/DIST. AVG. TAS-KTS.	-50 5900 13/78 414	-45 6120 14/84 419	-40 6380 14/90 423	-35 6680 15/97 428	-30 7020 17/106 432	-25 7430 18/116 437	-20 8040 20/131 442	-15 8890 23/153 446	-10 10060 27/182 449
23,000	SAT - °C FUEL-LB TIME/DIST. AVG. TAS-KTS.	-50 5630 12/72 409	-45 5840 13/77 414	-40 6070 13/83 418	-35 6340 14/89 423	-30 6650 15/96 428	-25 7000 17/105 432	-20 7500 18/117 437	-15 8200 21/134 441	-10 9180 24/159 444
22,000	SAT - °C FUEL-LB TIME/DIST. AVG. TAS-KTS.	-45 5510 12/70 408	-40 5710 12/74 413	-35 5950 13/80 417	-30 6220 14/86 421	-25 6530 15/93 426	-20 6920 16/103 430	-15 7490 18/116 433	-10 8290 21/135 437	-5 9400 25/162 439
20,000	SAT - °C FUEL-LB TIME/DIST. AVG. TAS-KTS.	-40 ● 5060 10/60 402	-35 ● 5250 11/64 406	-30 ● 5460 12/69 410	-25 ● 5710 13/74 414	-20 ● 5970 13/80 417	-15 ● 6350 15/88 421	-10 ● 6870 16/100 425	-5 7620 19/118 427	0 8660 22/142 429
15,000	SAT - °C FUEL-LB TIME/DIST. AVG. TAS-KTS.	-30 ● 3970 8/40 384	-25 ● 4110 8/43 388	-20 ● 4260 9/45 391	-15 ● 4450 9/49 395	-10 ● 4630 10/52 399	-5 ● 4890 11/57 402	0 ● 5290 12/66 405	+5 ● 5870 14/78 408	+10 ● 6690 17/95 410

NOTES:

1. FOR EACH 1000 FT. TAKE-OFF ABOVE SEA LEVEL [illegible] LBS. OF FUEL.
2. SAT IS TEMP. AT TOP OF CLIMB.
3. PERFORMANCE SHOWN ON THIS CHART IS BASED UPON CONSTANT [illegible] CLIMB SPEED.

TRANS WORLD AIRLINES

CONVAIR 880

PLANNING & PERFORMANCE

M .82
37000 FEET

SAMPLE

GROSS WT	OPERATING PARAMETER	OAT-C AMBIENT -70.0	-65.0	-60.0	-55.0	-50.0	-45.0	-40.0	STD. TEMP.-56.5 -35.0	-30.0
180000 LB	MACH/RAT	0.804/-42	0.804/-37	0.803/-31	0.783/-27					
	IAS/TAS	261/448	261/454	261/459	253/452					
	EPR A/L	2.56/2.56	2.57/2.57	2.56/2.56	2.54/2.54					
	N1	90.3	91.5	92.4	91.9					
	F/F	2860 B	2930 B	2960 B	2880 B					
	NAM/1000#	39.25	38.79	38.77	39.29					
170000 LB	MACH/RAT	0.815/-41	0.815/-36	0.815/-30	0.815/-25	0.803/-20	0.765/-17			
	IAS/TAS	265/455	265/461	265/466	265/471	261/470	247/452			
	EPR A/L	2.53/2.56	2.53/2.57	2.53/2.56	2.53/2.53	2.49/2.49	2.46/2.46			
	N1	90.5	91.6	92.8	93.7	93.4	92.0			
	F/F	2810 B	2860 B	2920 B	2950 B	2850 B	2710 B			
	NAM/1000#	40.59	40.27	39.95	39.91	41.20	41.75			
160000 LB	MACH/RAT	0.815/-41	0.815/-36	0.815/-30	0.815/-25	0.815/-19	0.811/-14	0.797/ -9		
	IAS/TAS	265/455	265/461	265/466	265/472	265/477	264/480	258/476		
	EPR A/L	2.45/2.56	2.45/2.57	2.45/2.56	2.45/2.53	2.46/2.48	2.44/2.44	2.40/2.40		
	N1	89.2	90.4	91.5	92.6	93.7	94.2	93.8		
	F/F	2600	2660	2710	2760	2820	2790	2700		
	NAM/1000#	43.75	43.39	43.05	42.72	42.40	42.97	44.20		
150000 LB	MACH/RAT	0.815/-41	0.815/-36	0.815/-30	0.815/-25	0.815/-19	0.815/-13	0.815/ -8	0.805/ -3	0.767/ -0
	IAS/TAS	265/455	265/461	265/466	265/472	265/477	265/482	265/488	261/486	248/468
	EPR A/L	2.37/2.56	2.37/2.57	2.38/2.56	2.38/2.53	2.38/2.48	2.39/2.43	2.39/2.39	2.35/2.35	2.33/2.33
	N1	88.2	89.3	90.4	91.5	92.6	93.6	94.7	94.5	93.5
	F/F	2430	2480	2530	2580	2630	2680	2730	2640	2510
	NAM/1000#	46.82	46.44	46.07	45.72	45.38	45.05	44.73	46.11	46.61
140000 LB	MACH/RAT	0.815/-41	0.815/-36	0.815/-30	0.815/-25	0.815/-19	0.815/-13	0.815/ -8	0.815/ -2	0.811/ 2
	IAS/TAS	265/455	265/461	265/466	265/472	265/477	265/482	265/488	265/493	264/495
	EPR A/L	2.30/2.56	2.31/2.57	2.31/2.56	2.31/2.53	2.32/2.48	2.32/2.43	2.32/2.39	2.32/2.34	2.31/2.31
	N1	87.2	88.4	89.5	90.5	91.6	92.7	93.7	94.8	95.3
	F/F	2290	2340	2380	2430	2480	2520	2570	2610	2600
	NAM/1000#	49.75	49.34	48.95	48.58	48.21	47.86	47.53	47.20	47.71
130000 LB	MACH/RAT	0.815/-41	0.815/-36	0.815/-30	0.815/-25	0.815/-19	0.815/-13	0.815/ -8	0.815/ -2	0.815/ 2
	IAS/TAS	265/455	265/461	265/466	265/472	265/477	265/482	265/488	265/493	265/498
	EPR A/L	2.24/2.56	2.25/2.57	2.25/2.56	2.25/2.53	2.26/2.48	2.26/2.43	2.26/2.39	2.26/2.34	2.27/2.30
	N1	86.5	87.6	88.7	89.8	90.8	91.9	92.9	93.9	94.9
	F/F	2170	2220	2260	2300	2350	2390	2430	2480	2520
	NAM/1000#	52.47	52.04	51.63	51.23	50.85	50.48	50.12	49.78	49.45
120000 LB	MACH/RAT	0.815/-41	0.815/-36	0.815/-30	0.815/-25	0.815/-19	0.815/-13	0.815/ -8	0.815/ -2	0.815/ 2
	IAS/TAS	265/455	265/461	265/466	265/472	265/477	265/482	265/488	265/493	265/498
	EPR A/L	2.19/2.56	2.20/2.57	2.20/2.56	2.20/2.53	2.20/2.48	2.21/2.43	2.21/2.39	2.21/2.34	2.21/2.30
	N1	85.9	87.0	88.0	89.1	90.2	91.2	92.2	93.2	94.3
	F/F	2070	2120	2160	2200	2240	2280	2330	2370	2410
	NAM/1000#	54.93	54.48	54.05	53.63	53.23	52.84	52.47	52.10	51.75
110000 LB	MACH/RAT	0.815/-41	0.815/-36	0.815/-30	0.815/-25	0.815/-19	0.815/-13	0.815/ -8	0.815/ -2	0.815/ 2
	IAS/TAS	265/455	265/461	265/466	265/472	265/477	265/482	265/488	265/493	265/498
	EPR A/L	2.15/2.56	2.15/2.57	2.15/2.56	2.16/2.53	2.16/2.48	2.16/2.43	2.17/2.39	2.17/2.34	2.17/2.30
	N1	85.4	86.5	87.5	88.6	89.6	90.7	91.7	92.7	93.7
	F/F	2000	2040	2080	2120	2160	2200	2240	2280	2320
	NAM/1000#	57.07	56.60	56.15	55.72	55.30	54.90	54.51	54.13	53.77

OAT (AMB)		STATION PRESSURE - IN. HG.																
		31		30		29		28		27		26		25		24		MAX.
°F	°C	EPR	RPM	EPR	RPM	EPR	RPM	EPR	RPM	EPR	RPM	EPR	RPM	EPR	RPM	EPR	RPM	RPM
*15	*26	2.52	93.5	2.52	93 5	2.52	93.5	2.52	93.5	2.52	93.5	2.52	93.5	2.52	93.3	2.52	93.3	98.1
-11	-24		93.9		93.9		93.9		93.9		93.9		93.9	2.52	93.7	2.52	93.7	98.5
- 7	-22		94.3		94.3		94.3		94.3		94.3		94.3	2.51	94.1	2.51	94.1	98.9
- 4	-20		94.6		94.6		94.6		94.6		94.6		94.6		94.4		94.4	99.3
0	-18		95.0		95.0		95.0		95.0		95.0		95.0		94.8		94.8	99.7
3	-16		95.4		95.4		95.4		95.4		95.4		95.4		95.2		95.2	100.1
7	-14		95.8		95.8		95.8		95.8		95.8		95.8		95.6		95.6	100.5
10	-12		96.1		96.1		96.1		96.1		96.1	2.52	95.9		95.9		95.9	100.9
14	-10		96.5		96.5		96.5		96.5		96.5	2.51	96.3		96.3		96.3	101 3
17	- 8		96.9		96.9		96.9		96.9	2.52	96.9		96.9		96.7		96.7	101.6
21	- 6		97.2		97.2		97.2		97.2	2.51	97.0		97.0		97.0		97.0	102.0
25	- 4		97.6		97.6		97.6	2.52	97.6		97.4		97.4		97.4		97.4	102.4
28	- 2		97.7		97.7		97.7	2.51	97.7		97.7		97.7		97.7		97.7	102.8
32	0		98.1		98.1		98.1		98.1		98.1		98.1		98.1		98.1	103.0
35	2		98.5		98.5		98.5		98.5		98.5		98.5		98.5		98.5	
39	4	2.52	98.8	2.52	98.8	2.52	98.8		98.8	2.51	98.8	2.51	98.8	2.51	98.8	2.51	98.8	
43	6	2.51	99.2	2 51	99.2	2.51	99.2	2.51	99.2	2.50	98.9	2.50	98.9	2.50	98.9	2.50	98.9	
46	8	2.50	99.2	2.50	99.2	2 50	99.2	2.50	99.2	2.49	98.9	2.49	98.9	2.49	98.9	2.49	98.9	
50	10	2.49	99.3	2.49	99.3	2.49	99.3	2.49	99.3	2.49	99.3	2.48	99.1	2.48	99.1	2.48	99.1	
54	12	2.49	99.6	2.49	99.6	2.49	99.6	2.49	99.6	2.49	99.6	2.48	99.5	2.48	99.5	2.48	99.5	
57	14	2.49	99.9	2 49	99.9	2.49	99.9	2.49	99.9	2.49	99.9	2.48	99.8	2.48	99 8	2.48	99.8	
61	16	2.48	100.2	2.48	100.2	2.48	100.2	2.48	100.2	2.48	100.2	2.48	100.2	2.48	100.2	2.48	100.2	
65	18	2.47	100.4	2.47	100.4	2.47	100.4	2.47	100.4	2.47	100.4	2.47	100.4	2.47	100.4	2.47	100.4	
68	20	2.46	100.5	2.46	100.5	2.46	100.5	2.46	100.5	2.46	100.5	2.46	100.5	2.46	100.5	2.46	100.5	
71	22	2.45	100.6	2.45	100.6	2.45	100.6	2.45	100.6	2.45	100.6	2.45	100.6	2.45	100.6	2.45	100.6	
75	24	2.44	100.7	2.44	100.7	2.44	100.7	2.44	100.7	2.44	100.7	2.44	100.7	2.44	100.7	2.44	100.7	
79	26	2.43	101.0	2.43	101.0	2.43	101.0	2.43	101.0	2.43	101.0	2.43	101.0	2.43	101.0	2.43	101.0	
82	28	2.42	101.1	2.42	101.1	2.42	101.1	2.42	101.1	2.42	101.1	2.41	101.1	2.41	101.1	2.41	101.1	
86	30	2.41	101.3	2.41	101.3	2.41	101.3	2.41	101.3	2.41	101.1	2.41	101.1	2.40	101.1	2.40	101.1	
90	32	2.40	101.4	2.40	101.4	2.40	101.4	2.40	101.4	2.39	101.2	2.39	101.2	2.39	101.2	2.39	101.2	
93	34	2.38	101.4	2.38	101.4	2.38	101.4	2.38	101.4	2.38	101.4	2.38	101.4	2.38	101.4	2.38	101.4	
97	36	2.37	101.4	2.37	101.4	2.37	101.4	2.37	101.4	2.37	101.4	2.36	101.4	2.36	101.4	2.36	101.4	
100	38	2.36	101.7	2.36	101.7	2.35	101.5	2.35	101.5	2.35	101.5	2.35	101.5	2.34	101.5	2.34	101.5	
104	40	2.34	101.6	2.34	101.6	2.34	101.6	2.34	101.6	2.33	101.6	2.33	101.6	2.33	101.5	2.33	101.5	
108	42	2.33	101.8	2.33	101.7	2.33	101.7	2.32	101.7	2.32	101.7	2.32	101.7	2.32	101.7	2.32	101.7	
111	44	2.31	101.8	2.31	101.8	2.31	101.8	2.30	101.8	2.30	101.7	2.30	101.7	2.30	101.7	2.30	101.7	
115	46	2.29	102.0	2.29	102.0	2.29	101.9	2.29	101.9	2.28	101.9	2.28	101.9	2.28	101.9	2.28	101.9	
118	48	2.28	102.0	2.28	102.0	2.28	102.0	2.28	101.9	2.27	101.9	2.27	101.9	2.27	101.9	2.27	101.9	
120	49	2.27	102.1	2.27	102.1	2.27	102.1	2.27	102.0	2.26	102.0	2.26	102.0	2.26	102.0	2.26	102.0	103.0

NOTES: 1. Exhaust Gas Temperature Limits
Type I - 632° C
Type II - 700° C or 650° C for 15 seconds.

2. EGT Decrease with Engine Bleed Valve Closed.
Two Turbocompressors Operating - 7° C
Two Turbocompressors Operating plus Engine Anti-Ice and rain clearing 10° C

3. To obtain Station Pressure, Read Indicated Altitude as Pressure (1000' = 1" hg) and Subtract from Altimeter Setting.

* Temperatures colder than -15° F (-26° C) Use EPR shown for -15° F

RAT	INDICATED MACH NO .56	.58	.60	.62	.64	.66	.68	.70	.72	.74	.76	.78	.80	.82	.84	.86	.88	.90
	AMBIENT AIR TEMP-CENTIGRADE																	
40.	20.	19.	18.	16.	15.	14.	13.	11.	10.	9.	7.	6.	4.	3.	1.	-0.	-2.	-4.
38.	18.	17.	16.	15.	13.	12.	11.	10.	8.	7.	5.	4.	3.	1.	-1.	-2.	-4.	-6.
36.	16.	15.	14.	13.	11.	10.	9.	8.	6.	5.	4.	2.	1.	-1.	-2.	-4.	-6.	-8.
34.	14.	13.	12.	11.	10.	8.	7.	6.	5.	3.	2.	0.	-1.	-3.	-4.	-6.	-7.	-9.
32.	12.	11.	10.	9.	8.	7.	5.	4.	3.	1.	0.	-1.	-3.	-4.	-6.	-7.	-9.	-11.
30.	10.	9.	8.	7.	6.	5.	3.	2.	1.	-0.	-2.	-3.	-5.	-6.	-8.	-9.	-11.	-13.
28.	9.	7.	6.	5.	4.	3.	2.	0.	-1.	-2.	-4.	-5.	-6.	-8.	-9.	-11.	-13.	-15.
26.	7.	6.	4.	3.	2.	1.	-0.	-1.	-3.	-4.	-5.	-7.	-8.	-10	-11.	-13.	-14.	-16.
24.	5.	4.	3.	1.	0.	-1.	-2.	-3.	-5.	-6.	-7.	-9.	-10	-11.	-13.	-14.	-16.	-18.
22.	3.	2.	1.	-0.	-2.	-3.	-4.	-5.	-6.	-8.	-9.	-10.	-12.	-13.	-15.	-16.	-18.	-20.
20.	1.	0.	-1.	-2.	-3.	-5.	-6.	-7.	-8.	-10	-11.	-12.	-14.	-15.	-16.	-18.	-20.	-21.
18.	-1.	-2.	-3.	-4.	-5.	-6.	-8.	-9.	-10.	-11.	-13.	-14.	-15.	-17.	-18.	-20.	-21.	-23.
16.	-3.	-4.	-5.	-6.	-7.	-8.	-9.	-11.	-12.	-13.	-14.	-16.	-17.	-19.	-20.	-21.	-23.	-25.
14.	-5.	-6.	-7.	-8.	-9.	-10.	-11.	-13.	-14.	-15.	-16.	-18.	-19.	-20.	-22.	-23.	-25.	-27.
12.	-7.	-8.	-9.	-10	-11.	-12.	-13.	-14.	-16.	-17.	-18.	-19.	-21.	-22.	-24.	-25.	-27.	-28.
10.	-8.	-9.	-11.	-12.	-13.	-14.	-15.	-16.	-17.	-19.	-20.	-21.	-23.	-24.	-25.	-27.	-28.	-30.
8.	-10.	-11.	-12.	-13.	-15.	-16.	-17.	-18.	-19.	-20.	-22.	-23.	-24.	-26.	-27.	-29.	-30.	-32.
6.	-12.	-13.	-14.	-15.	-16.	-18.	-19.	-20.	-21.	-22.	-24.	-25.	-26.	-27.	-29.	-30.	-32.	-34.
4.	-14.	-15.	-16.	-17.	-18.	-19.	-21.	-22.	-23.	-24.	-25.	-27.	-28.	-29.	-31.	-32.	-34.	-35.
2.	-16.	-17.	-18.	-19.	-20.	-21.	-22.	-24.	-25.	-26.	-27.	-28.	-30.	-31.	-32.	-34.	-35.	-37.
0.	-18.	-19.	-20.	-21.	-22.	-23.	-24.	-25.	-27.	-28.	-29.	-30.	-31.	-33.	-34.	-36.	-37.	-39.
-2.	-20.	-21.	-22.	-23.	-24.	-25.	-26.	-27.	-28.	-30.	-31.	-32.	-33.	-35.	-36.	-37.	-39.	-41.
-4.	-22.	-23.	-24.	-25.	-26.	-27.	-28.	-29.	-30.	-31.	-33.	-34.	-35.	-36.	-38.	-39.	-41.	-42.
-6.	-24.	-25.	-26.	-27.	-28.	-29.	-30.	-31.	-32.	-33.	-34.	-36.	-37.	-38.	-40.	-41.	-42.	-44.
-8.	-25.	-26.	-27.	-28.	-29.	-31.	-32.	-33.	-34.	-35.	-36.	-37.	-39.	-40.	-41.	-43.	-44.	-46.
-10.	-27.	-28.	-29.	-30.	-31.	-32.	-33.	-35.	-36.	-37.	-38.	-39.	-40.	-42.	-43.	-44.	-46.	-48.
-12.	-29.	-30.	-31.	-32.	-33.	-34.	-35.	-36.	-38.	-39.	-40.	-41.	-42.	-44.	-45.	-46.	-48.	-49.
-14.	-31.	-32.	-33.	-34.	-35.	-36.	-37.	-38.	-39.	-40.	-42.	-43.	-44.	-45.	-47.	-48.	-49.	-51.
-16.	-33.	-34.	-35.	-36.	-37.	-38.	-39.	-40.	-41.	-42.	-43.	-45.	-46.	-47.	-48.	-50.	-51.	-53.
-18.	-35.	-36.	-37.	-38.	-39.	-40.	-41.	-42.	-43.	-44.	-45.	-46.	-48.	-49.	-50.	-51.	-53.	-54.
-20.	-37.	-38.	-39.	-40.	-41.	-42.	-43.	-44.	-45.	-46.	-47.	-48.	-49.	-51.	-52.	-53.	-55.	-56.
-22.	-39.	-40.	-41.	-42.	-43.	-44.	-45.	-46.	-47.	-48.	-49.	-50.	-51.	-52.	-54.	-55.	-56.	-58.
-24.	-41.	-42.	-42.	-43.	-44.	-45.	-46.	-47.	-48.	-50.	-51.	-52.	-53.	-54.	-55.	-57.	-58.	-60.
-26.	-43.	-43.	-44.	-45.	-46.	-47.	-48.	-49.	-50.	-51.	-53.	-54.	-55.	-56.	-57.	-58.	-60.	-61.
-28.	-44.	-45.	-46.	-47.	-48.	-49.	-50.	-51.	-52.	-53.	-54.	-55.	-57.	-58.	-59.	-60.	-62.	-63.
-30.	-46.	-47.	-48.	-49.	-50.	-51.	-52.	-53.	-54.	-55.	-56.	-57.	-58.	-60.	-61.	-62.	-63.	-65.
-32.	-48.	-49.	-50.	-51.	-52.	-53.	-54.	-55.	-56.	-57.	-58.	-59.	-60.	-61.	-63.	-64.	-65.	-67.
-34.	-50.	-51.	-52.	-53.	-54.	-55.	-56.	-57.	-58.	-59.	-60.	-61.	-62.	-63.	-64.	-66.	-67.	-68.
-36.	-52.	-53.	-54.	-55.	-56.	-56.	-57.	-58.	-59.	-61.	-62.	-63.	-64.	-65.	-66.	-67.	-69.	-70.
-38.	-54.	-55.	-56.	-57.	-57.	-58.	-59.	-60.	-61.	-62.	-63.	-64.	-66.	-67.	-68.	-69.	-70.	-72.
-40.	-56.	-57.	-57.	-58.	-59.	-60.	-61.	-62.	-63.	-64.	-65.	-66.	-67.	-68.	-70.	-71.	-72.	-74.

* * *

CLIMB THRUST SETTING CHART

IND RAT	EPR	RPM S. L.	RPM 30,000'	RPM 40,000'
40	2.09	98.2	98.5	98.8
38	2.11	98.2	98.5	98.6
36	2.13	98.0	98.3	98.4
34	2.15	97.8	98.2	98.5
32	2.17	97.8	98.2	98.5
30	2.19	97.6	98.1	98.3
28	2.21	97.6	97.9	98.3
26	2.23	97.5	97.9	98.2
24	2.25	97.4	97.8	98.2
22	2.27	97.3	97.7	98.0
20	2.28	97.1	97.6	97.9
18	2.30	97.2	97.6	97.8
16	2.32	97.0	97.5	97.8
14	2.30	96.4	96.9	97.2
12	2.31	96.3	96.9	97.2
10	2.33	96.1	96.8	97.1
8	2.34	96.0	96.6	96.9
6	2.36	96.0	96.6	96.9
4	2.37	95.8	96.4	96.8
2	2.38	95.6	96.2	96.6
0	2.40	95.6	96.2	96.6
- 2	2.41	95.4	96.0	96.4
- 4	2.42	95.2	95.9	96.3
- 6	2.44	95.2	95.9	96.3
- 8	2.45	95.0	95.8	96.1
-10	2.46	94.8	95.6	96.0
-12	2.47	94.6	95.5	95.9
-14	2.49	94.6	95.5	95.9
-16	2.50	94.5	95.4	95.8
-18	2.51	94.4	95.2	95.7
-20	2.52	94.3	95.1	95.6
-22	2.53	94.1	95.1	95.5
-24	2.54	94.0	94.9	95.3
-26	2.55	93.8	94.7	95.3
-28	2.56	93.6	94.5	95.2
-30	2.56	93.2	94.1	94.7

NOTE: Max. EGT Limit is 560°C.

MAXIMUM CRUISE THRUST LIMIT CHART

IND RAT	EPR
40	1.99
38	2.01
36	2.03
34	2.06
32	2.08
30	2.10
28	2.12
26	2.14
24	2.16
22	2.18
20	2.20
18	2.22
16	2.23
14	2.25
12	2.26
10	2.27
8	2.28
6	2.28
4	2.30
2	2.31
0	2.32
- 2	2.34
- 4	2.36
- 6	2.37
- 8	2.39
-10	2.40
-12	2.42
-14	2.44
-16	2.46
-18	2.47
-20	2.49
-22	2.50
-24	2.51
-26	2.53

MINIMUM COST CRUISE (M.80)

ALTITUDE	GROSS WEIGHT							
	180,000	170,000	160,000	150,000	140,000	130,000	120,000	110,000
41,000					235/-51 2.50/-20	235/-40 2.41/-10	235/* 2.33/*	235/* 2.26/*
39,000			246/-55 2.54/-26	246/-46 2.46/-16	246/-39 2.38/-8	246/* 2.31/*	246/* 2.25/*	246/* 2.19/*
37,000	258/-60 2.56/-32	258/-50 2.49/-20	258/-42 2.42/-12	258/-35 2.35/-4	258/* 2.29/*	258/* 2.23/*	258/* 2.18/*	258/* 2.13/*
35,000	270/-44 2.44/-14	270/-39 2.38/-8	270/-32 2.32/-1	270/* 2.26/*	270/* 2.21/*	270/* 2.17/*	270/* 2.13/*	270/* 2.09/*
33,000	282/-34 2.33/-3	282/* 2.28/*	282/* 2.23/*	282/* 2.19/*	282/* 2.15/*	282/* 2.11/*	282/* 2.08/*	282/* 2.06/*
31,000	295/* 2.24/*	295/* 2.20/*	295/* 2.16/*	295/* 2.13/*	295/* 2.10/*	295/* 2.07/*	295/* 2.05/*	295/* 2.03/*
29,000	308/* 2.17/*	308/* 2.14/*	308/* 2.11/*	308/* 2.08/*	308/* 2.06/*	308/* 2.04/*	308/* 2.02/*	308/* 2.01/*
28,000	315/* 2.14/*	315/* 2.11/*	315/* 2.09/*	315/* 2.06/*	315/* 2.04/*	315/* 2.03/*	315/* 2.02/*	315/* 2.01/*
27,000	322/* 2.11/*	322/* 2.09/*	322/* 2.06/*	322/* 2.05/*	322/* 2.03/*	322/* 2.02/*	322/* 2.01/*	322/* 2.00/*
26,000	328/* 2.09/*	328/* 2.07/*	328/* 2.05/*	328/* 2.03/*	328/* 2.02/*	328/* 2.01/*	328/* 2.00/*	328/* 1.99/*
25,000	335/* 2.07/*	335/* 2.05/*	335/* 2.03/*	335/* 2.02/*	335/* 2.01/*	335/* 2.00/*	335/* 1.99/*	335/* 1.99/*
24,000	342/* 2.05/*	342/* 2.03/*	342/* 2.02/*	342/* 2.01/*	342/* 2.00/*	342/* 1.99/*	342/* 1.98/*	342/* 1.98/*
23,000	349/* 2.03/*	349/* 2.02/*	349/* 2.01/*	349/* 2.00/*	349/* 1.99/*	349/* 1.98/*	349/* 1.98/*	349/* 1.98/*
22,000	356/* 2.02/*	356/* 2.00/*	356/* 1.99/*	356/* 1.99/*	356/* 1.98/*	356/* 1.98/*	356/* 1.98/*	356/* 1.98/*
21,000	363/* 2.01/*	363/* 2.00/*	363/* 1.99/*	363/* 1.98/*	363/* 1.98/*	363/* 1.98/*	363/* 1.98/*	363/* 1.98/*
20,000	370/* 2.00/*	370/* 1.99/*	370/* 1.98/*	370/* 1.98/*	370/* 1.97/*	370/* 1.97/*	370/* 1.97/*	370/* 1.97/*
19,000	378/* 1.98/*	378/* 1.98/*	378/* 1.97/*	378/* 1.97/*	378/* 1.97/*	378/* 1.97/*	378/* 1.97/*	378/* 1.97/*
18,000	385/* 1.98/*	385/* 1.97/*	385/* 1.97/*	385/* 1.97/*	385/* 1.97/*	385/* 1.97/*	385/* 1.97/*	385/* 1.97/*
17,000	386/* 1.95/*	386/* 1.94/*	386/* 1.94/*	386/* 1.94/*	386/* 1.94/*	386/* 1.94/*	386/* 1.94/*	386/* 1.94/*
16,000	385/* 1.92/*	385/* 1.91/*	385/* 1.91/*	385/* 1.90/*	385/* 1.90/*	385/* 1.90/*	385/* 1.90/*	385/* 1.90/*
15,000	384/* 1.89/*	384/* 1.88/*	384/* 1.88/*	384/* 1.88/*	384/* 1.87/*	384/* 1.87/*	384/* 1.87/*	384/* 1.87/*
14,000	382/* 1.86/*	382/* 1.85/*	382/* 1.85/*	382/* 1.85/*	382/* 1.84/*	382/* 1.84/*	382/* 1.84/*	382/* 1.84/*
13,000	382/* 1.83/*	382/* 1.83/*	382/* 1.82/*	382/* 1.82/*	382/* 1.82/*	382/* 1.82/*	382/* 1.82/*	382/* 1.82/*
12,000	381/* 1.80/*	381/* 1.80/*	381/* 1.79/*	381/* 1.79/*	381/* 1.79/*	381/* 1.79/*	381/* 1.79/*	381/* 1.79/*
11,000	380/* 1.78/*	380/* 1.77/*	380/* 1.77/*	380/* 1.77/*	380/* 1.77/*	380/* 1.77/*	380/* 1.77/*	380/* 1.77/*
10,000	379/* 1.75/*	379/* 1.75/*	379/* 1.74/*	379/* 1.74/*	379/* 1.74/*	379/* 1.74/*	379/* 1.74/*	379/* 1.74/*

NOTES:
1. EPR value is average required to maintain Min. Cost speed.
2. RAT and SAT are Max. Cruise thrust limit temperatures for EPR shown.
3. (*) Cruise thrust limit temperatures are hotter than experienced in operation (above Std. + 30° C.).
4. IND. MACH will be .796 above 18,000 feet and V_{mo} minus 10 kts. below.

DATA PRESENTED IS: IAS/SAT
EPR/RAT

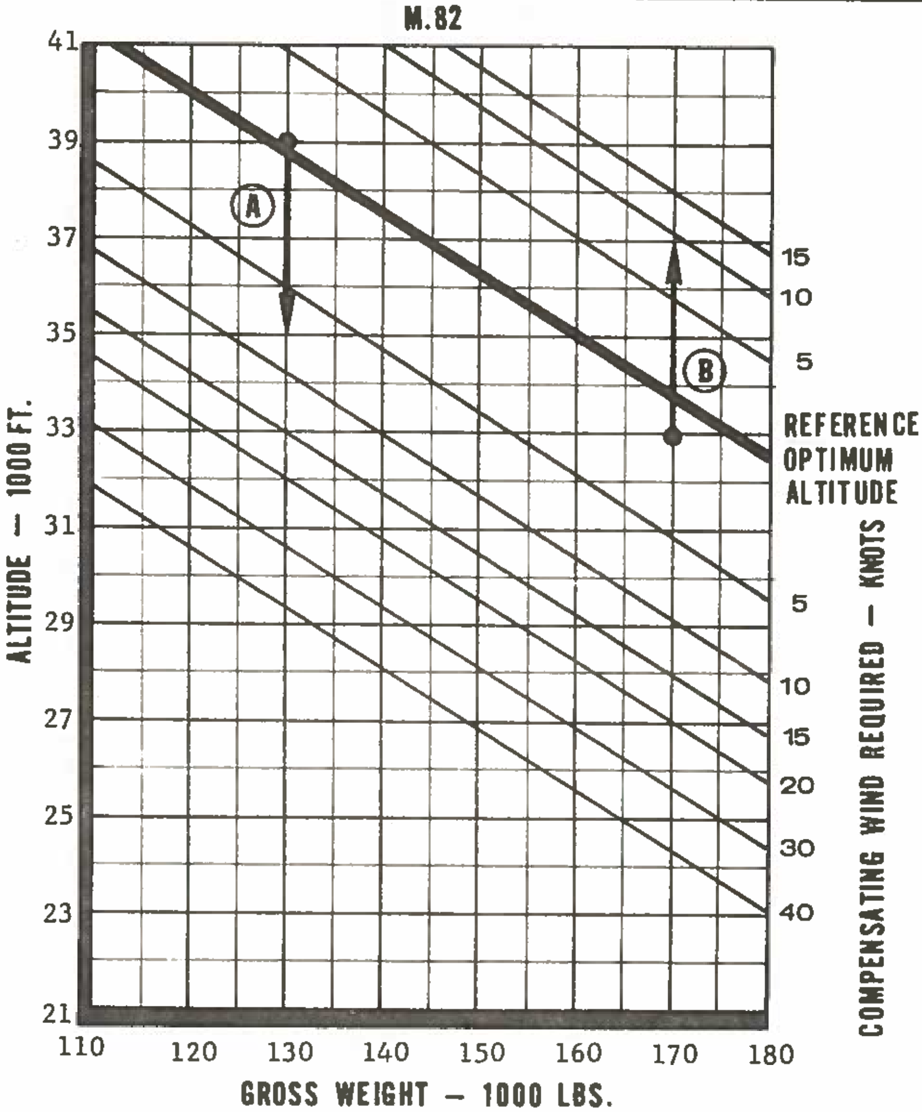
1.3G MANEUVER CAPABILITY
1.5G MANEUVER CAPABILITY

MINIMUM COST CRUISE (M.82)

ALTITUDE	OPERATING PARAMETER	GROSS WEIGHT 180,000	170,000	160,000	150,000	140,000	130,000	120,000	110,000
41,000	IAS/OAT EPR/RAT					242/-58 2.54/-28	242/-47 2.45/-16	242/-38 2.37/-6	242/-29 2.30/+3
39,000	1.3G				253/-52 2.50/-22	253/-44 2.42/-12	253/-34 2.34/-3	253/-27 2.28/+5	253/-15 2.23/+17
37,000			265/-55 2.53/-25	265/-50 2.46/-19	265/-40 2.39/-8	265/-32 2.32/0	265/-22 2.26/+10	265/* 2.21/*	265/* 2.17/*
35,000	1.5G	277/-50 2.48/-19	277/-45 2.41/-13	277/-37 2.35/-4	277/-29 2.29/+3	277/-18 2.24/+14	277/* 2.19/*	277/* 2.16/*	277/* 2.12/*
33,000		290/-39 2.37/-7	290/-31 2.31/+1	290/-24 2.26/+9	290/-17 2.22/+16	290/* 2.18/*	290/* 2.13/*	290/* 2.11/*	290/* 2.09/*
31,000		303/-24 2.27/+9	303/-19 2.23/+15	303/-13 2.19/+21	303/* 2.16/*	303/* 2.13/*	303/* 2.11/*	303/* 2.09/*	303/* 2.07/*
29,000		317/-20 2.20/+14	317/-10 2.16/+24	317/* 2.13/*	317/* 2.11/*	317/* 2.09/*	317/* 2.07/*	317/* 2.05/*	317/* 2.04/*
28,000		323/-9 2.17/+25	323/-6 2.14/+28	323/* 2.12/*	323/* 2.09/*	323/* 2.07/*	323/* 2.06/*	323/* 2.05/*	323/* 2.04/*
27,000		330/-7 2.14/+27	330/* 2.12/*	330/* 2.09/*	330/* 2.07/*	330/* 2.06/*	330/* 2.05/*	330/* 2.04/*	330/* 2.03/*
26,000		337/-5 2.12/+29	337/* 2.09/*	337/* 2.08/*	337/* 2.06/*	337/* 2.04/*	337/* 2.03/*	337/* 2.03/*	337/* 2.02/*
25,000		344/-5 2.09/+32	344/* 2.07/*	344/* 2.06/*	344/* 2.05/*	344/* 2.04/*	344/* 2.03/*	344/* 2.02/*	344/* 2.02/*
24,000		351/* 2.07/*	351/* 2.06/*	351/* 2.05/*	351/* 2.04/*	351/* 2.03/*	351/* 2.02/*	351/* 2.02/*	351/* 2.01/*
23,000		358/* 2.06/*	358/* 2.05/*	358/* 2.04/*	358/* 2.03/*	358/* 2.02/*	358/* 2.01/*	358/* 2.01/*	358/* 2.01/*
22,000		366/* 2.04/*	366/* 2.03/*	366/* 2.02/*	366/* 2.01/*	366/* 2.01/*	366/* 2.01/*	366/* 2.01/*	366/* 2.01/*
21,000		373/* 2.03/*	373/* 2.02/*	373/* 2.02/*	373/* 2.01/*	373/* 2.01/*	373/* 2.01/*	373/* 2.01/*	373/* 2.01/*
20,000		380/* 2.02/*	380/* 2.01/*	380/* 2.01/*	380/* 2.00/*	380/* 2.00/*	380/* 2.00/*	380/* 2.00/*	380/* 2.00/*
19,000		387/* 2.01/*	387/* 2.01/*	387/* 2.00/*	387/* 2.00/*	387/* 2.00/*	387/* 2.00/*	387/* 2.00/*	387/* 2.00/*
18,000		386/* 1.98/*	386/* 1.98/*	386/* 1.98/*	386/* 1.98/*	386/* 1.98/*	386/* 1.98/*	386/* 1.98/*	386/* 1.98/*
17,000		386/* 1.94/*	386/* 1.94/*	386/* 1.93/*	386/* 1.93/*	386/* 1.93/*	386/* 1.93/*	386/* 1.93/*	386/* 1.93/*
16,000		385/* 1.91/*	385/* 1.90/*	385/* 1.90/*	385/* 1.90/*	385/* 1.89/*	385/* 1.89/*	385/* 1.89/*	385/* 1.89/*
15,000		384/* 1.88/*	384/* 1.87/*	384/* 1.87/*	384/* 1.87/*	384/* 1.87/*	384/* 1.87/*	384/* 1.87/*	384/* 1.87/*
14,000		382/* 1.85/*	382/* 1.85/*	382/* 1.84/*	382/* 1.84/*	382/* 1.84/*	382/* 1.84/*	382/* 1.84/*	382/* 1.84/*
13,000		382/* 1.83/*	382/* 1.82/*	382/* 1.82/*	382/* 1.82/*	382/* 1.82/*	382/* 1.81/*	382/* 1.81/*	382/* 1.81/*
12,000		381/* 1.80/*	381/* 1.80/*	381/* 1.79/*	381/* 1.79/*	381/* 1.79/*	381/* 1.79/*	381/* 1.79/*	381/* 1.79/*
11,000		380/* 1.77/*	380/* 1.77/*	380/* 1.76/*	380/* 1.76/*	380/* 1.76/*	380/* 1.76/*	380/* 1.76/*	380/* 1.76/*
10,000		379/* 1.75/*	379/* 1.74/*	379/* 1.74/*	379/* 1.74/*	379/* 1.74/*	379/* 1.74/*	379/* 1.74/*	379/* 1.74/*

NOTES:
1. EPR value is average required to maintain Min. Cost speed.
2. RAT & OAT are Max. Cruise thrust limit temperatures for EPR shown.
3. (*) Cruise thrust limit temperatures are hotter than experienced in operation. (Above Std. +30°C)
4. IND. MACH will be .815 above 19,000 ft. and V_{mo} minus 10 kts. below.

M.82



This chart provides a rapid means of determining minimum cost altitude for any flight condition. The heavy line represents a reference altitude for determining where the aircraft should operate at a given weight and zero wind gradient condition (the same wind at all altitudes). The light lines labeled Compensating Wind Required represent the additional favorable wind required to justify flying at other than the reference altitude.

Example A. At 130,000 lbs. to justify changing altitude from 39,000 ft. to 35,000 ft., at least 8 kts. of more favorable wind component is required.

Example B. The additional favorable wind required at 170,000 lbs. to justify going from 33,000 to 37,000 ft. would be 8 kts.- (10 kts. at 37,000 ft. less 2 kts. at 33,000 ft.)

Note: For altitude capability check M.82 cruise charts.

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ALTITUDE	OPERATING PARAMETER	GROSS WEIGHT 180,000	170,000	160,000	150,000	140,000	130,000	120,000	110,000
41,000	IAS/OAT EPR/RAT					238/-50 2.50/-20	238/-40 2.40/-9	238/-30 2.32/0	235/-23 2.25/+7
39,000				250/-58 2.55/-29	250/-48 2.46/-18	250/-38 2.38/-7	249/-30 2.30/+1	245/* 2.24/*	240/* 2.15/*
37,000		261/-59 2.56/-30	262/-50 2.49/-20	261/-40 2.40/-9	261/-35 2.35/-3	260/* 2.27/*	256/* 2.21/*	251/* 2.14/*	243/* 2.09/*
35,000		274/-45 2.44/-14	273/-37 2.37/-6	273/-30 2.31/+1	271/* 2.24/*	267/* 2.18/*	261/* 2.12/*	254/* 2.07/*	245/* 2.01/*
33,000		286/-34 2.33/-2	284/-25 2.27/+7	282/* 2.21/*	277/* 2.15/*	271/* 2.10/*	264/* 2.05/*	256/* 2.00/*	247/* 1.94/*
31,000		296/* 2.22/*	292/* 2.18/*	287/* 2.13/*	282/* 2.09/*	275/* 2.04/*	266/* 1.99/*	258/* 1.93/*	248/* 1.88/*
29,000		302/* 2.15/*	297/* 2.11/*	291/* 2.07/*	284/* 2.02/*	276/* 1.98/*	268/* 1.93/*	258/* 1.88/*	248/* 1.81/*
28,000		305/* 2.10/*	299/* 2.06/*	293/* 2.02/*	285/* 1.98/*	277/* 1.94/*	268/* 1.89/*	259/* 1.84/*	249/* 1.78/*
27,000		307/* 2.07/*	301/* 2.03/*	294/* 1.99/*	286/* 1.95/*	278/* 1.90/*	269/* 1.86/*	259/* 1.81/*	249/* 1.75/*
26,000		309/* 2.03/*	302/* 2.00/*	295/* 1.96/*	287/* 1.92/*	278/* 1.87/*	269/* 1.83/*	259/* 1.78/*	249/* 1.73/*
25,000		310/* 2.00/*	303/* 1.97/*	295/* 1.93/*	287/* 1.89/*	278/* 1.84/*	269/* 1.80/*	260/* 1.75/*	250/* 1.70/*
24,000		311/* 1.97/*	304/* 1.93/*	296/* 1.90/*	288/* 1.86/*	279/* 1.81/*	270/* 1.77/*	260/* 1.72/*	250/* 1.67/*
23,000		312/* 1.94/*	304/* 1.91/*	296/* 1.87/*	288/* 1.83/*	279/* 1.79/*	270/* 1.74/*	260/* 1.70/*	250/* 1.65/*
22,000		313/* 1.91/*	305/* 1.87/*	297/* 1.84/*	288/* 1.80/*	279/* 1.76/*	270/* 1.71/*	261/* 1.67/*	251/* 1.62/*
21,000		313/* 1.88/*	305/* 1.85/*	297/* 1.81/*	289/* 1.77/*	280/* 1.73/*	270/* 1.69/*	261/* 1.65/*	251/* 1.60/*
20,000		314/* 1.85/*	306/* 1.82/*	297/* 1.78/*	289/* 1.74/*	280/* 1.70/*	271/* 1.66/*	261/* 1.62/*	252/* 1.58/*
19,000		314/* 1.82/*	306/* 1.79/*	298/* 1.75/*	289/* 1.72/*	280/* 1.68/*	271/* 1.64/*	262/* 1.60/*	252/* 1.56/*
18,000		314/* 1.80/	306/* 1.76/*	298/* 1.73/*	290/* 1.69/*	281/* 1.66/*	272/* 1.62/*	263/* 1.58/*	253/* 1.54/*
17,000		315/* 1.77/*	307/* 1.74/*	298/* 1.70/*	290/* 1.67/*	281/* 1.63/*	272/* 1.59/*	263/* 1.56/*	254/* 1.52/*
16,000		315/* 1.74/*	307/* 1.71/*	299/* 1.68/*	290/* 1.64/*	282/* 1.61/*	273/* 1.57/*	264/* 1.54/*	255/* 1.50/*
15,000		315/* 1.72/*	307/* 1.69/*	299/* 1.65/*	290/* 1.62/*	282/* 1.59/*	273/* 1.55/*	264/* 1.52/*	255/* 1.48/*
14,000		316/* 1.69/*	308/* 1.66/*	300/* 1.63/*	291/* 1.60/*	283/* 1.57/*	274/* 1.53/*	266/* 1.50/*	257/* 1.47/*
13,000		316/* 1.67/*	308/* 1.64/*	300/* 1.61/*	292/* 1.58/*	284/* 1.55/*	275/* 1.52/*	267/* 1.48/*	258/* 1.45/*
12,000		316/* 1.65/*	309/* 1.62/*	301/* 1.59/*	293/* 1.56/*	284/* 1.53/*	276/* 1.50/*	268/* 1.47/*	259/* 1.44/*
11,000		317/* 1.63/*	309/* 1.60/*	301/* 1.57/*	293/* 1.54/*	285/* 1.51/*	277/* 1.48/*	269/* 1.45/*	260/* 1.42/*
10,000		317/* 1.60/*	309/* 1.58/*	301/* 1.55/*	293/* 1.52/*	285/* 1.49/*	277/* 1.47/*	269/* 1.44/*	260/* 1.41/*

NOTES: 1. EPR value is average required to maintain LRC speed.

2. RAT & OAT are Max. Cruise thrust limit temperatures for EPR shown.

3. (*) Cruise thrust limit temperatures are hotter than experienced in operation. (Above Std. +30°C)

C/HOLD THRUST
TTING CHART

TRANS WORLD AIRLINES
CONVAIR 880
PLANNING & PERFORMANCE

TITUDE	OPERATING PARAMETER	GROSS WEIGHT 180,000	170,000	160,000	150,000	140,000	130,000	120,000	110,000
1,000	IAS/OAT EPR/RAT					221/-45 2.48/-18	219/-35 2.39/-8	215/* 2.31/*	210/* 2.22/*
,000				231/-50 2.52/-23	231/-40 2.43/-13	228/-30 2.36/-3	225/* 2.28/*	219/* 2.21/*	212/* 2.13/*
7,000		242/-54 2.55/-28	242/-45 2.47/-18	241/-36 2.40/-8	238/-28 2.33/0	234/* 2.26/*	228/* 2.20/*	222/* 2.12/*	214/* 2.05/*
5,000		253/-38 2.42/-10	251/-32 2.35/-4	247/* 2.29/*	243/* 2.22/*	237/* 2.16/*	231/* 2.10/*	223/* 2.04/*	214/* 1.97/*
3,000		260/-28 2.32/0	257/* 2.25/*	252/* 2.20/*	246/* 2.15/*	239/* 2.09/*	232/* 2.03/*	223/* 1.96/*	214/* 1.89/*
1,000		266/* 2.21/*	261/* 2.16/*	255/* 2.11/*	248/* 2.06/*	240/* 2.00/*	232/* 1.94/*	223/* 1.88/*	213/* 1.82/*
9,000		269/* 2.12/*	263/* 2.08/*	256/* 2.03/*	249/* 1.98/*	241/* 1.92/*	232/* 1.87/*	223/* 1.81/*	213/* 1.75/*
8,000		270/* 2.08/*	264/* 2.04/*	256/* 1.99/*	249/* 1.94/*	240/* 1.89/*	232/* 1.83/*	222/* 1.78/*	212/* 1.72/*
7,000		271/* 2.04/*	264/* 2.00/*	257/* 1.95/*	249/* 1.90/*	240/* 1.85/*	231/* 1.80/*	222/* 1.74/*	212/* 1.69/*
6,000		271/* 2.01/*	264/* 1.96/*	257/* 1.92/*	249/* 1.87/*	240/* 1.82/*	231/* 1.77/*	221/* 1.71/*	212/* 1.66/*
5,000		272/* 1.97/*	264/* 1.93/*	257/* 1.88/*	248/* 1.83/*	240/* 1.79/*	231/* 1.74/*	221/* 1.68/*	211/* 1.63/*
4,000		272/* 1.93/*	264/* 1.89/*	256/* 1.85/*	248/* 1.80/*	239/* 1.75/*	230/* 1.70/*	221/* 1.66/*	211/* 1.60/*
3,000		272/* 1.90/*	264/* 1.86/*	256/* 1.81/*	248/* 1.77/*	239/* 1.72/*	230/* 1.68/*	220/* 1.63/*	211/* 1.58/*
2,000		271/* 1.87/*	264/* 1.82/*	256/* 1.78/*	247/* 1.74/*	239/* 1.69/*	230/* 1.65/*	220/* 1.60/*	211/* 1.55/*
1,000		271/* 1.83/*	263/* 1.79/*	255/* 1.75/*	247/* 1.71/*	238/* 1.67/*	229/* 1.62/*	220/* 1.58/*	210/* 1.53/*
0,000		271/* 1.80/*	263/* 1.76/*	255/* 1.72/*	247/* 1.68/*	238/* 1.64/*	229/* 1.60/*	220/* 1.55/*	210/* 1.51/*
9,000		271/* 1.77/*	263/* 1.73/*	255/* 1.69/*	246/* 1.65/*	238/* 1.61/*	229/* 1.57/*	220/* 1.53/*	210/* 1.49/*
8,000		270/* 1.74/*	262/* 1.70/*	254/* 1.67/*	246/* 1.63/*	237/* 1.59/*	228/* 1.55/*	219/* 1.51/*	210/* 1.47/*
7,000		270/* 1.71/*	262/* 1.68/*	254/* 1.64/*	245/* 1.60/*	237/* 1.56/*	228/* 1.53/*	219/* 1.49/*	210/* 1.45/*
6,000		269/* 1.69/*	262/* 1.65/*	253/* 1.62/*	245/* 1.58/*	237/* 1.54/*	228/* 1.51/*	219/* 1.47/*	210/* 1.43/*
5,000		269/* 1.66/*	261/* 1.62/*	253/* 1.59/*	245/* 1.56/*	237/* 1.52/*	228/* 1.48/*	219/* 1.45/*	210/* 1.41/*
4,000		269/* 1.64/*	261/* 1.60/*	253/* 1.57/*	245/* 1.54/*	237/* 1.50/*	228/* 1.46/*	219/* 1.43/*	210/* 1.40/*
3,000		268/* 1.61/*	261/* 1.58/*	253/* 1.55/*	245/* 1.52/*	237/* 1.48/*	228/* 1.45/*	219/* 1.42/*	210/* 1.38/*
2,000		268/* 1.59/*	261/* 1.56/*	252/* 1.53/*	244/* 1.50/*	237/* 1.46/*	228/* 1.43/*	219/* 1.40/*	211/* 1.37/*
1,000		267/* 1.56/*	260/* 1.53/*	252/* 1.50/*	244/* 1.48/*	237/* 1.44/*	229/* 1.42/*	220/* 1.39/*	211/* 1.36/*
0,000		267/* 1.54/*	260/* 1.51/*	252/* 1.48/*	244/* 1.45/*	237/* 1.42/*	229/* 1.40/*	220/* 1.37/*	212/* 1.34/*
1,500		267/* 1.39/*	261/* 1.37/*	254/* 1.35/*	247/* 1.33/*	240/* 1.30/*	233/* 1.28/*	226/* 1.26/*	219/* 1.24/*

NOTES: 1. EPR value is average required to maintain MRC/HOLD speed.

2. RAT & OAT are Max. Cruise thrust limit temperatures for EPR shown.

3. (*) Cruise thrust limit temperatures are hotter than experienced in operation. (Above Std. +30°C)

A. PREMISES

1. Alternate Planning

a. Fuel required value shown includes one-half distance credit for climb to alternate cruising altitude following missed approach, cruise fuel at LRC schedule to alternate, 15 minutes holding at alternate, plus 1500 lbs. for descent and approach.

b. Time value shown includes time to climb at one-half distance credit to cruise altitude, time to cruise at LRC schedule to over alternate, plus 8 minutes for descent and approach. 15 minutes hold time is not included in this total.

c. TAS value shown is average for the cruise portion.

d. The altitude shown for the respective NAM column is the optimum cruise altitude considering the above parameters.

e. All Alternate Planning values reflect standard day temperatures.

2. Flight Planning

a. Flight Planning fuel time, and average TAS tabulations are provided for M. 82, and LRC cruise schedules.

b. Fuel values shown are from brake release to landing and integrate fuel requirements for takeoff, climb, cruise, en route descent to 20,000' over destination, plus 1500 lbs. for descent and approach.

c. Time values shown are from brake release to over destination at 20,000' plus 8 minutes for descent and approach.

d. TAS values are the average for the cruise portion.

e. Planning data shown with an asterisk in the block upon a 4000' step climb. Two asterisks indicates a 6000' step climb is required. Step climb to final altitude is assumed to be accomplished when LRC speed schedule can be maintained at that altitude. Initial cruise altitude speed will not be less than that at which 99% maximum range can be attained.

f. Time and fuel values do not include taxi or reserve requirements.

B. HOW TO USE CHARTS

1. Alternate Planning

a. If an alternate is required, determine ground mileage to alternate from "Distance to Alternate Airports" section 03.05 or from the route chart. Enter alternate planning chart column nearest this distance to obtain TAS and altitude.

b. With forecast wind for the altitude, obtain nautical air miles by setting computer $\frac{TAS}{GS} = \frac{NAM}{NGM}$.

c. Enter mileage column nearest NAM computed to determine fuel, time, optimum altitude, and cruising average TAS at LRC schedule.

2. Flight Planning

a. Determine estimated landing weight at destination by completion of first 8 blocks of weight determination column of flight plan-flight log form.

(1) FAA Reserve = 5000 lbs.
(2) TWA Reserve = 2000 lbs.
(3) Hold at destination computed using appropriate holding chart for anticipated ATC delay.
(4) Fuel to alternate (if required) as previously determined.
(5) Operating weight empty - from flight dispatch or station weight and balance manual.
(6) Estimated payload - from flight dispatch.
(7) Summation of (1) through (6) constitutes estimated landing weight.

b. For ground distance to destination refer to route ground mileage chart.

c. The flight should be planned at the minimum cost altitude as determined from the minimum cost alt/wind trade chart using the corresponding wind differential and average cruise weight. On a long flight when planning a step climb, the initial altitude should be selected on the basis of the average weight prior to the step climb.

d. Select flight planning chart for desired altitude and cruising schedule.

e. Using ground mileage for distance read average TAS for cruise in the estimated landing weight bracket and opposite the forecast average temperature.

f. With average wind component for the route, determine air miles by setting computer $\frac{TAS}{GS} = \frac{NAM}{NGM}$

g. Re-enter chart at NAM computed and read trip time, fuel, and average TAS opposite forecast temperature. Interpolate between columns as necessary.

h. Add trip fuel to estimated landing weight to find estimated takeoff weight.

i. Refer to climb performance chart for the estimated takeoff weight to determine aircraft cruising capabilities at top of climb.

j. Repeat preceding steps "B-2-b through h", for other available routes or altitudes.

C. ALTERNATE PLANNING CHART

DIST. - NAM	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160
OPTM. ALT.	2000	3000	4000	5000	6000	7000	8000	9000	10000	11000	12000	13000	14000	15000	16000
TIME	:12	:15	:18	:20	:22	:24	:26	:28	:30	:31	:33	:34	:36	:38	:39
FUEL	3850	4800	5500	6120	6690	7170	7600	8000	8340	8700	9050	9360	9680	9950	10220
TAS	311	313	314	316	318	320	323	325	328	331	334	337	340	344	349

DIST. - NAM	170	180	190	200	210	220	230	240	250	260	270	280	290	300	310
OPTM. ALT.	17000	18000	19000	20000	21000	22000	23000	24000	25000	26000	27000	28000	29000	30000	31000
TIME	:41	:42	:44	:45	:47	:48	:50	:51	:5[illegible]	:54	:56	:57	:58	1:00	1:01
FUEL	10480	10730	11000	11240	11470	11750	11970	12180	12390	12600	12810	13010	13200	13410	13600
TAS	353	358	363	368	373	378	383	388	393	399	405	410	415	421	426

DIST. - NAM	320	330	340	350	360	370	380	390	400	410	420	430	440	450	460
* OPTM. ALT.	32000	33000	34000	35000	35000	35000	35000	35000	35000	35000	35000	35000	35000	35000	35000
TIME	1:02	1:04	1:05	1:06	1:08	1:09	1:10	1:11	1:13	1:14	1:15	1:16	1:18	1:19	1:20
FUEL	13800	14000	14200	14400	14600	14790	14970	15130	15300	15500	15700	15870	16040	16210	16390
TAS	432	438	444	449	449	449	449	449	449	449	449	449	449	449	449

* DIST. - NAM	470	480	490	500	510	520	530	540	550	560	570	580	590	600
OPTM. ALT.	35000	35000	35000	35000	35000	35000	35000	35000	35000	35000	35000	35000	35000	35000
* TIME	1:21	1:22	1:24	1:25	1:26	1:27	1:28	1:30	1:31	1:32	1:33	1:34	1:36	1:37
FUEL	16560	16730	16910	17080	17260	17420	17600	17760	17920	18100	18380	18430	18590	18770
TAS	449	449	449	449	449	449	449	449	449	449	449	449	449	449

NOTES:

1. Fuel includes ½ climb distance en route credit, fuel to cruise remaining distance at LRC schedule, 15 minutes holding at alternate, and 1500 lbs. for descent.

2. Time includes ½ climb distance credit, time to cruise distance shown at LRC schedule and 8 minutes for descent. 15 minutes holding is not included in time.

A. DISTANCES BETWEEN REGULAR AIRPORTS

		N. MI.	VIA
ABQ	ORD	1030	JR-78 - 26 - 87
BAL	BOS	328	V-1681 - 1733, to ARD, JR-8 - 55
	EWR	147	V-1681 - 1733 - V-433
BOS	JFK	163	JR-55 - 77
	LAX	2286	JR-16 to ALB, JR-82 to JOT, JR-64
	LAX	2365	JR-16 to ALB, JR-49 to PSB, JR-78
CMH	JFK	430	JR-80
DAY	JFK	514	JR-29 - 60
DEN	JFK	1421	JR-60
	JFK	1463	JR-80
	ORD	802	JR-60 - 87
IND	JFK	589	JR-80
LAS	ORD	1352	JR-60 - 87
LAX	ABQ	585	JR-78
	BAL	2064	JR-78 - 42
	DEN	759	JR-60
	JFK	2158	JR-64 - 60
	JFK	2180	JR-60
	JFK	2215	JR-78 - 42
	JFK	2243	JR-78
	LAS	209	JR-60
	MKC	1199	JR-64 - 80
	MKC	1253	JR-78 - 26
	OKC	1030	JR-78 - 6
	ORD	1539	JR-64 - 87
	ORD	1561	JR-60 - 87
	ORD	1615	JR-78 - 26 - 87
	PHL	2139	JR-78 - 42
	PHX	329	JR-4
	STL	1393	JR-64 - 80
	STL	1431	JR-78 - 8
MKC	ABQ	668	JR-26 to AMA, JR-78
	JFK	983	JR-80
	ORD	362	JR-87
	STL	194	JR-80
OKC	TUL	107	JR-8
ORD	BAL	562	JR-16 - 34 - 12
	BOS	761	JR-16 - 70 - 82 - 16
	BOS	764	JR-16
	DAY	214	V-228 - 55
	JFK	641	V-1506 - 1676, JR-70
	JFK	660	JR-16 - 34 - 60
	PHL	621	JR-16 - 34 - 64
	PHX	1303	JR-26 to AMA, JR-78 to GNT, JR-24
	PIT	392	JR-16 - 34
PHX	ABQ	273	JR-24
	MKC	941	JR-24 - 78 - 26
	ORD	1303	JR-24 - 78 - 26 - 87
PIT	CVG	255	V-1723 to PKB, V-1534 to YRK, V-1646
	STL	495	JR-80
SFO	BAL	2170	JR-84 - 60 - 34 - 12
	BAL	2177	JR-80 - 12
	BAL	2179	JR-80 - 64 - 12
	JFK	2259	JR-80 - 60
	JFK	2268	JR-84 - 60
	JFK	2270	JR-94 - 70
	LAS	401	JR-92
	LAX	294	JR-1
	ORD	1628	JR-94 - 90
	ORD	1633	JR-84
STL	BAL	665	JR-80 - 12
	CVG	254	V-1526 to ABB, V-1741
	JFK	789	JR-80
	IND	200	JR-80
	MIA	955	JR-45 - 89
	MIA	1034	JR-35 - 41
	OKC	406	JR-8
	TUL	299	JR-8
	DTW	411	JR-101 - 16 - 70

22130
6,870

7000
15130
22130

B. DISTANCES TO ALTERNATE AIRPORTS

The following distances are airway mileages only and should be used when determining alternate fuel and time requirements from Alternate Planning Charts. Do not add departure mileage to these distances since the Alternate Planning Chart includes time and fuel to climb to cruising altitude by the most devious means. Distances between regular airports are listed in the preceding paragraphs and are not duplicated in the following list for alternate use.

		N. MI.
ABQ	AMA	255
	COS	243
	DEN	340
	TUS	305
BAL	JFK	166
	PHL	82
	PIT	170
BOS	BDL	84
	BED	20
	EWR	188
	PHL	246
	PIT	446
DAY	CLE	130
	CMH	85
	CVG	57
	IND	92
	PIT	204
	SDF	124
	STL	292
	DTW	146
DEN	ABQ	340
	AMA	323
	COS	57
	SLC	337
DTW	CLE	79
	CMH	148
	CVG	199
	DAY	146
	IND	255
	ORD	224
	PIT	199

5000
15,500
20,500

4500

362

448
27950

3. DISTANCES TO ALTERNATE AIRPORTS

		N. MI.
JFK -	BAL	166
	EWR	24
	PHL	87
	PIT	294
IND -	CLE	221
	CMH	178
	CVG	93
	DAY	92
	ORD	156
	PIT	295
	SDF	110
	DTW	255
LAS -	PHX	237
	SLC	332
	TUS	332
LAX -	FAT	188
	LGB	21
	ONT	42
	PMD	51
MIA -	ATL	519
	JAX	284
	TPA	166
MKC -	AMA	413
	ICT	164
	IND	394
	MEM	347
	OMA	125
	SDF	429
	TUL	199
ORD -	CLE	319
	CMH	306
	CVG	249
	IND	156
	MSP	315
	MKE	60
	SDF	268
	STL	233
	DTW	224
PHL -	BAL	85
	BOS	246
	EWR	74
	JFK	87
	PIT	225
PHX -	LAS	237
	TUS	95
PIT -	BAL	170
	BOS	446
	CLE	116
	CMH	117
	DAY	204
	EWR	260
	JFK	294
	IND	295
	PHL	225
	SDF	296
	DTW	199
SFO -	FAT	167
	OAK	25
	SLC	532
STL -	CMH	378
	DAY	292
	ICT	358
	MEM	231
	OMA	319
	ORD	233
	SDF	235
	TUL	299
	DTW	411

* * *

A. TWA's Flight Planning Policy has the basic objective of operating as economically as possible and the standard cruise Mach number has been selected with this objective in mind. Flights will be planned and operated at standard cruise speed and as close to minimum cost altitude as possible. There will be no deviation from this policy for the purpose of making up time. The scheduled airtimes are calculated to produce a standard percentage of arrivals on time and are based on historical performance on each route segment.

1. LRC will be used for Flight Planning only when payload cannot be carried at standard cruise speed.

2. When equipment is substituted for another model having a different standard cruise speed, use the standard cruise speed for the aircraft being flown.

3. To provide en route flexibility, calculation of trip fuel shall normally be based on the next lower directional altitude (2000' lower up to flight level 290 and 4000' lower above 290). This formula will be considered in the dispatch release message and is also accounted for in the Standard Fuels Tables computed for trip segments of 900 miles and less. Additional en route flexibility for extreme cases exists in the capability to fly long range cruise.

B. Considering the policy outlined above, select the flight plan parameters as follows:

1. Considering total payload available and/or holding requirements, plan flight at standard cruise speed and as near minimum cost altitude as possible. The resultant fuel figure will normally reflect less fuel than the dispatch release which is based on the formula in A.3.

2. If payload cannot be accommodated due to weight restrictions, use trip fuel at the optimum altitude determined in Paragraph "B-1" preceding.

3. If payload still cannot be accommodated then plan flight at LRC at optimum fuel altitude.

4. If payload still cannot be accommodated consider only mail allocation and revenue passenger load.

5. If insufficient fuel for the flight still exists, then consider only revenue passenger load to meet requirements. If this does not allow sufficient fuel, then a fuel stop will be considered and the full payload accepted if possible. It should be remembered that additional flexibility en route to accept adverse altitude restrictions is provided for in the Company Reserve fuel on Domestic and 10% time en route fuel on International.

C. MINIMUM FUEL FOR TAKEOFF

The minimum fuel for takeoff shall never be less than that required for en route operation and normal reserves. If fuel has to be added to meet this requirement, then the total minimum fuel shall not be less than 20,000 pounds, which is the lowest amount shown in the distribution tables. In no case will takeoff fuel be less than 12,000 pounds.

* * *

TRANS WORLD AIRLINES

CONVAIR 880

PLANNING & PERFORMANCE

M.82
FLT. PLANNING
P.A.—37000 FEET

SAMPLE

STD. TEMP. -56.5 C — DISTANCE - NAUTICAL MILES

LOG WT	TEMP C		300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600
155000	-30	TIME														
		FUEL														
		TAS														
	-40	TIME														
		FUEL														
		TAS														
	-50	TIME														
		FUEL														
		TAS														
	-60	TIME		1.02	1.15											
		FUEL		14450	16900											
		TAS		466	466											
	-70	TIME		1.03	1.16	1.30	1.43	1.56	2.09	2.22						
		FUEL		14200	16550	18950	21500	24050	26550	28850						
		TAS		455	455	455	455	455	455	459•						
145000	-30	TIME														
		FUEL														
		TAS														
	-40	TIME														
		FUEL														
		TAS														
	-50	TIME		1.02	1.14	1.27	1.39	1.52	2.04	2.17	2.29	2.42	2.54	3.07		
		FUEL		14100	16400	18700	21050	23550	25950	28400	30850	33400	35950	38500		
		TAS		477	477	477	477	479•	479•	480•	480•	480•	480•	480•		
	-60	TIME		1.02	1.15	1.28	1.41	1.54	2.07	2.20	2.32	2.45	2.57	3.10		
		FUEL		13850	16100	18400	20750	23150	25600	28000	30450	32950	35450	37950		
		TAS		466	466	466	466	466	466	466	470•	470•	470•	470•		
	-70	TIME		1.03	1.16	1.29	1.43	1.56	2.09	2.22	2.36	2.49	3.02	3.15		
		FUEL		13600	15800	18000	20350	22750	25100	27500	29900	32450	35000	37550		
		TAS		455	455	455	455	455	455	455	455	455	455	455		
135000	-30	TIME														
		FUEL														
		TAS														
	-40	TIME					1.38	1.50	2.02	2.15	2.27	2.39	2.51	3.03	3.16	3.28
		FUEL					20650	23050	25450	27850	30250	32700	35200	37700	40200	42700
		TAS					488	489•	490•	490•	491•	491•	491•	491•	491•	492•
	-50	TIME		1.01	1.14	1.27	1.39	1.52	2.04	2.17	2.30	2.42	2.55	3.07	3.20	3.32
		FUEL		13550	15700	17850	20100	22400	24650	26950	29250	31700	34100	36550	39000	41500
		TAS		477	477	477	477	477	477	477	477	478•	478•	478•	479•	479•
	-60	TIME		1.02	1.15	1.28	1.41	1.54	2.07	2.19	2.32	2.45	2.58	3.11	3.23	3.36
		FUEL		13250	15400	17500	19750	22000	24250	26500	28750	31150	33600	36000	38350	40850
		TAS		466	466	466	466	466	466	466	466	466	466	466	468•	468•
	-70	TIME		1.03	1.16	1.29	1.42	1.56	2.09	2.22	2.35	2.49	3.02	3.15	3.28	3.41
		FUEL		13000	15050	17150	19350	21550	23800	26000	28200	30600	32950	35350	37700	40150
		TAS		455	455	455	455	455	455	455	455	455	455	455	455	455
125000	-30	TIME					1.37	1.49	2.01	2.13	2.25	2.37	2.49	3.01	3.13	3.25
		FUEL					20800	22950	25200	27800	30200	32600	35050	37550	40000	42500
		TAS					498	498	497	500•	500•	501•	501•	501•	501•	501•
	-40	TIME		1.01	1.13	1.25	1.38	1.50	2.02	2.15	2.27	2.39	2.52	3.04	3.16	3.28
		FUEL		13450	15550	17650	19750	21950	24150	26350	28550	30750	33150	35550	37950	40350
		TAS		488	488	488	488	488	488	488	488	488	489•	489•	489•	490•
	-50	TIME		1.01	1.14	1.26	1.39	1.52	2.04	2.17	2.29	2.42	2.55	3.07	3.20	3.32
		FUEL		13000	15050	17100	19200	21350	23500	25650	27800	30050	32350	34600	36900	39200
		TAS		477	477	477	477	477	477	477	477	477	477	477	477	477
	-60	TIME		1.02	1.15	1.28	1.41	1.53	2.06	2.19	2.32	2.45	2.58	3.11	3.24	3.37
		FUEL		12700	14700	16700	18800	20900	23050	25200	27300	29500	31750	34000	36300	38550
		TAS		466	466	466	466	466	466	466	466	466	466	466	466	466
	-70	TIME	0.49	1.03	1.16	1.29	1.42	1.55	2.09	2.22	2.35	2.48	3.02	3.15	3.28	3.41
		FUEL	10450	12400	14400	16350	18450	20500	22600	24700	26750	28950	31150	33350	35600	37800
		TAS	455	455	455	455	455	455	455	455	455	455	455	455	455	455
115000	-30	TIME			1.13	1.25	1.37	1.49	2.01	2.13	2.25	2.37	2.49	3.02	3.13	3.25
		FUEL			15700	17800	19800	21950	24050	26250	28400	30500	32700	34950	37500	39900
		TAS			498	498	498	498	498	498	498	498	498	498	499•	499•
	-40	TIME		1.01	1.13	1.25	1.38	1.50	2.02	2.15	2.27	2.39	2.52	3.04	3.16	3.29
		FUEL		12900	14900	16900	18900	20950	23050	25150	27250	29350	31550	33750	35950	38150
		TAS		488	488	488	488	488	488	488	488	488	488	488	488	488
	-50	TIME		1.01	1.14	1.26	1.39	1.52	2.04	2.17	2.29	2.42	2.55	3.07	3.20	3.32
		FUEL		12450	14400	16350	18350	20400	22450	24450	26550	28600	30750	32900	35100	37250
		TAS		477	477	477	477	477	477	477	477	477	477	477	477	477
	-60	TIME	0.49	1.02	1.15	1.27	1.40	1.53	2.06	2.19	2.32	2.45	2.58	3.11	3.24	3.37
		FUEL	10250	12150	14100	16000	18000	20000	22000	24000	26000	28100	30200	32300	34450	36550
		TAS	466	466	466	466	466	466	466	466	466	466	466	466	466	466
	-70	TIME	0.49	1.02	1.16	1.29	1.42	1.55	2.08	2.22	2.35	2.48	3.01	3.15	3.28	3.41
		FUEL	10000	11900	13750	15650	17600	19550	21550	23500	25500	27500	29600	31700	33750	35800
		TAS	455	455	455	455	455	455	455	455	455	455	455	455	455	455

A. Standard fuels as herein listed shall normally be used to simplify planning on the shorter route segments and to expedite Captain/ Dispatcher coordination.

1. If route conditions are within the parameters upon which standard fuels are calculated, it is sufficient for planning purposes to assume trip fuel to equal standard fuel minus 7, 000# reserve, and trip time to equal scheduled time.

2. Preferential fuel over and above standard may be shown as holding and/ or alternate fuel.

3. Fuel less than standard shall be used when necessary to resolve payload or operational restrictions arising from use of the standard.

4. Fuel higher than standard shall be used when necessary to provide for alternate or holding requirements or for more adverse en route conditions than standard fuel will cover.

B. The parameters on which standard fuels are calculated are selected to encompass a very high percentage of flight conditions encountered. The assumed wind component is zero eastbound, and -50 westbound; the altitude assumed is 2000 feet below optimum up to flight level 290 and 4000 feet below optimum above FL 290; the assumed type cruise is Minimum Cost (M. 82); and the assumed payload is space limit of 23, 500 lbs.

C. Explanation of Columns:

(1) Route segment ground distance. (Use nearest value shown) USE CHART APPROPRIATE TO DIRECTION OF FLIGHT, EASTBOUND or WESTBOUND.

(2) Standard usable flight level nearest optimum altitude.

(3) Standard fuel including standard reserves. Reserves are 5000# - FAA and 2000# Company. It does not include alternate or holding fuel.

(4) Standard takeoff weight assuming standard fuel and space limit (23, 500 lbs) payload.

(5) Approximate landing weight which will result from most favorable wind component considered (+70 eastbound and zero westbound), and standard takeoff weight as derived above.

(6) Segments and amounts of preferential fuel desired are listed at the releasing Flight Dispatch offices and will be included in the dispatch release whenever significant savings in operating costs can be realized.

The amount of preferential fuel is calculated to permit landing at 132, 000 lbs. carrying space limit payload, with the most favorable wind component, cruising at an altitude of next lower same direction flight level below optimum.

(7) The highest cruising flight level which can be used and still arrive at destination within 135, 000 lbs. landing weight if alternate holding or preferential fuel added to increase estimated landing weight to 132, 000 lbs. and most favorable wind component experienced.

D. When alternate and/ or holding fuel is required, a check to determine if arrival within maximum landing weight limits can be expected is as follows:

1. If preferential fuel shown and total fuel required is less than preferential fuel, no further check is necessary.

2. If no preferential fuel is shown, or the total required fuel exceeds that value, add amount of required fuel above standard fuel to estimated landing weight (column 5) to find expected arrival weight. If this exceeds maximum landing weight, reduce column 5 weight by amount estimated payload is less than space limit (23, 500 lbs.), and re-calculate for arrival within maximum landing weight limit. If limit still exceeded, plan flight for actual conditions from flight planning charts to determine fuel requirement and permissible payload.

FUELS CHARTS

EASTBOUND
Valid for component spread 0 to +70.
Fuel based on unfavorable component of 0.

(1) Ground Distance Nautical Miles	(2) Opt-imum Alt.	(3) Std. Fuel Including 7000# Res.	(4) Space Payload T.O. Weights	(5) Approximate Ldg. Weight Resulting From Most Fav. Comp.	(6) Check Alt. (See Note)
20	30	13600*	129300	122800	130
40	50	13900*	129600	122800	150
60	70	14300*	130000	122900	170
80	90	14700*	130400	122900	190
100	130	15100*	130800	123000	230
120	150	15400*	131100	123000	250
140	170	15800*	131500	123100	270
160	190	16200*	131900	123100	290
180	210	16600*	132300	123200	330
200	230	16900*	132600	123200	330
220	230	17300*	133000	123200	330
240	250	17800*	133500	123300	370
260	250	18200*	133900	123400	370
280	270	18700*	134400	123500	370
300	270	19100*	134800	123600	370
320	290	19500*	135200	123600	410
340	290	19900*	135600	123600	410
360	290	20400	136100	123800	410
380	290	20800	136500	123800	410
400	290	21200	136900	123900	410
420	290	21700	137400	124100	410
440	290	22200	137900	124200	410
460	290	22700	138400	124300	410
480	290	23200	138900	124300	410
500	290	23600	139300	124300	410
520	290	24000	139700	124300	410
540	290	24300	140000	124300	410
560	330	24700	140400	124300	410
580	330	25100	140800	124300	410
600	330	25500	141200	124300	410
620	330	26000	141700	124300	410
640	330	26500	142200	124300	410
660	330	27000	142700	124300	410
680	330	27500	143200	124300	410
700	330	28000	143700	124300	410
720	330	28400	144100	124300	410
740	330	28900	144600	124300	410
760	330	29400	145100	124300	410
780	330	29900	145600	124300	410
800	330	30400	146100	124300	410
820	330	30900	146600	124300	410
840	330	31400	147100	124300	410
860	330	31900	147600	124300	410
880	330	32400	148100	124300	410
900	330	32800	148500	124300	410

WESTBOUND
Valid for component spread -50 to 0.
Fuel based on unfavorable component of -50.

(1) Ground Distance Nautical Miles	(2) Opt-imum Alt.	(3) Std. Fuel Including 7000# Res.	(4) Space Payload T.O. Weights	(5) Approximate Ldg. Weight Resulting From Most Fav. Comp.	(6) Check Alt. (See Note)
20	40	13600*	129300	122700	140
40	60	14000*	129700	122800	160
60	80	14500*	130200	122900	180
80	120	14900*	130600	122900	220
100	140	15300*	131000	122900	240
120	160	15800*	131500	123100	260
140	180	16300*	132000	123200	280
160	200	16700*	132400	123200	310
180	200	17200*	132900	123300	310
200	220	17700*	133400	123300	310
220	240	18000*	133700	123300	350
240	240	18400*	134100	123300	350
260	260	18800*	134500	123300	350
280	260	19300*	135000	123300	350
300	280	19700*	135400	123300	350
320	280	20000	135700	123300	350
340	280	20500	136200	123300	350
360	280	21000	136700	123300	350
380	280	21400	137100	123300	350
400	310	21900	137600	123300	390
420	310	22300	138000	123300	390
440	310	22900	138600	123400	390
460	310	23400	139100	123400	390
480	310	23900	139600	123400	390
500	310	24500	140200	123600	390
520	310	25000	140700	123700	390
540	310	25600	141300	124000	390
560	310	26200	141900	124200	390
580	310	26800	142500	124400	390
600	310	27400	143100	124600	390
620	310	28000	143700	124700	390
640	310	28600	144300	124800	390
660	310	29200	144900	124900	390
680	310	29800	145500	125000	390
700	310	30300	146000	125000	390
720	310	30900	146600	125200	390
740	310	31500	147200	125300	390
760	310	32100	147800	125400	390
780	310	32600	148300	125400	390
800	310	33100	148800	125400	390
820	310	33700	149400	125500	390
840	310	34200	149900	125500	390
860	310	37400	150400	125500	390
880	310	35200	150900	125500	390
900	310	35700	151400	125600	390

(1) Check altitude represents highest flight level that can be used (with most favorable component) if estimated landing weight increased to 132,000 lbs. by addition of alternate, holding or preferential fuel and still remain within 135,000 lbs. maximum allowable landing weight.

(2) *The minimum fuel for takeoff shall never be less than required for enroute operation and normal reserves. In no case will takeoff fuel be less than 20,000 lbs. if fuel added or 12,000 lbs. if fueled - through.

WEIGHT AND BALANCE DATA

Configuration	Cabin Cockpit	Cabin	Weight	BRN
→ C20-70	3	4	92, 500	43

NOTE
If ACM carried on flight deck add 190 Lbs. to weight and reduce BRN one unit.

H. STABILIZER TRIM CHART

When a trim computer is not available, takeoff stab. trim setting may be obtained by adding the appropriate trim indices for passenger and cargo and subtracting the indices for fuel.

The takeoff stabilizer trim must be adjusted for takeoff weights less than 135, 000 pounds.

Passengers - Aft	Passengers - Forward 0-5	6-10	11-15	16-20	21-25	26-30
0-10	3. 0	3. 5	3. 8	4. 3	4. 7	4. 8
11-20	2. 7	3. 2	3. 5	3. 9	4. 4	4. 6
21-30	2. 3	2. 7	3. 2	3. 6	4. 0	4. 3
31-40	1. 9	2. 4	2. 8	3. 2	3. 6	4. 0
41-50	1. 5	2. 1	2. 5	2. 8	3. 2	3. 6
51-60	1. 3	1. 7	2. 2	2. 5	2. 8	3. 3
61-70	1. 0	1. 3	1. 9	2. 2	2. 6	2. 9

Adjustment For Takeoff Weight

134, 999 to 125, 000	-1. 0
125, 000 & Below	-2. 0

Aft Hold Cargo - Pounds	Forward Hold Cargo - Pounds 0 to 999	1000 to 1999	2000 to 2999	3000 to 3999	4000 to 4999
0 to 999	2. 0	2. 6	3. 1	3. 4	3. 6
1000 to 1999	1. 6	2. 2	2. 6	3. 0	3. 5
2000 to 2999	1. 1	1. 7	2. 2	2. 7	3. 3
3000 to 3999	0. 6	1. 2	1. 8	2. 2	2. 8
4000 to 4999	0. 1	0. 7	1. 4	1. 8	2. 2

Psgr - 9 fwd, 58 aft
Cargo - 2100 fwd, 58 aft
Fuel - 23, 000 pounds
Takeoff weight - 128, 403

Psgr	=	+1. 7
Cargo	=	+3. 1
Fuel	=	-0. 1
Adjustment	=	-1. 0
Stab Trim	=	+3. 7

Fuel Load - Pounds	
0 to 25, 000	-0. 1
25, 000 to 35, 000	-0. 3
35, 001 to 56, 000	-0. 6
56, 001 to 62, 000	-1. 2
62, 001 to 64, 000	-1. 7
64, 001 to 67, 000	-1. 3
67, 001 to 70, 000	-0. 8
70, 001 to FULL	-0. 5

* * *

A. TAKEOFF GROSS WEIGHT DATA

1. Tabulated takeoff gross weight charts, which contain all the required performance data for takeoff except thrust setting, are provided for all authorized runways. The gross weight charts are divided into three sections; takeoff gross weight, takeoff speeds, and the associated notes.

a. The gross weight section consists of a temperature column and two gross weight columns, and if applicable a tire speed column.

(1) The Temperature column covers the usual span of temperatures up to the airport maximum operating temperature (MOT).

(2) The Zero Wind weight column accounts for runway length and gradient, airport elevation, brake energy limitations and obstacle clearance. If sufficient obstacle clearance cannot be provided utilizing the standard takeoff profile, a turn will be specified on the chart. All turn calculations are based on intiaiting a 15° banked turn to a specified heading at 300 feet above the ground.

(3) The Struct/Climb Limit column reflects two weight considerations. The maximum structural takeoff gross weight or the maximum gross weight that can satisfy the minimum FAA climb requirements for the station elevation and associated temperature.

(4) The Tire Limit column, if applicable, reflects the highest gross weight/$V_{lift\ off}$ combination that will not exceed the speed limitation of the tires.

b. The takeoff speed section consists of an actual gross weight column and the corresponding V_1, V_2, V_{mcg}, $V_{2\ min}$ and V_r increments.

c. The notes on the top of the Gross Weight chart consist of aircraft and airport characteristic used to cross check available conditions. The notes down the left side of the chart consist of standard notes that are used to adjust the temperature, zero wind and tire limit columns and V_1 speeds. The lower note box contains additional information on such things as noise abatement, turn information, etc.

2. The limiting gross weights and speeds necessary for the takeoff data card are calculated from the takeoff chart in the following manner:

a. The Runway Limit Weight is the weight derived from the Zero Wind column adjusted for effective headwind or tailwind component. The runway limit weight is always used as the basis for making V_1 adjustments and weight corrections for slush. It may be the maximum weight permitted for takeoffs. To calculate the runway limit weight, use the appropriate runway chart and proceed as follows:

(1) If the altimeter setting is 29.70 or above, enter the zero wind column with the airport temperature and read the zero wind gross weight. Adjust this zero wind gross weight for effective headwind or tailwind component by the pound per knot wind factor shown in the gross weight correction box.

(2) If the altimeter setting is below 29.70, adjust the temperature by increasing 1°F for each .1"hg. the setting is below 29.70, and use this adjusted temperature to determine the zero wind gross weight.

If the adjusted temperature exceeds the last temperature shown on the page (the airport MOT) extrapolate the zero wind gross weight as necessary using the last interval as a basis. This extrapolation can only be done to compensate for barometric pressure differences. At no time can the aircraft be operated when the outside air temperature exceeds the MOT.

(3) This Runway Limit Weight should be entered in the appropriate space on the takeoff data card. This weight will always be used as the basis for making V_1 reductions when actual weight is less than runway limit weight.

b. The Maximum Takeoff Weight is the most limiting gross weight derived from the takeoff gross weight chart. It is the lesser of the runway limit as calculated above and the following additional limit weight considerations:

(Note: None of the following adjustments alter the runway limit weight previously entered on the takeoff data card.)

(1) Struct/Climb Limit Weight. - At the temperature used to derive the zero wind gross weight, read the Struct/Climb Limit column. The struct/climb limit weight cannot be adjusted for wind.

(2) Tire Limit Weight. - If a Tire Limit column exists, enter with the same temperature and read the Tire Limit gross weight. Adjust it for the actual headwind or tailwind component using the pound per knot value in the gross weight correction box.

(3) Slush Maximum Weight. - If slush, wet snow or standing water is present, subtract 5% from the runway limit weight.

(4) Enter the most restrictive gross weight calculated above in the Maximum Takeoff Weight location on the takeoff data card.

c. To calculate the takeoff speed proceed as follows:

(1) Read V_{mcg} & $V_{2\ min}$ for the airport temperature, interpolating as necessary, and enter them on the takeoff data card. If the temperature is colder than 20°F, use value shown for 20°F.

(2) To calculate V_2 enter the speed columns with the actual takeoff gross weight and read V_2 directly and compare it to $V_{2\ min}$. Enter the higher of the two speeds on the T/O data card.

(3) To calculate V_r proceed horizontally at the actual gross weight and under the airport temperature read the V_r increment (knots less than V_2 at which V_r occurs). Enter the V_r increment and the computed V_r in the appropriate space on the takeoff data card. The V_r schedule accounts for all minimum V_r requirements. If the resulting V_r is less than V_{mcg} increase V_r to V_{mcg}.

(4) To calculate the minimum V_1, read the V_1 opposite the actual takeoff gross weight and reduce it 1 knot for every 1000 lbs. the actual takeoff gross weight is less than the runway limit weight, but not less than V_{mcg}. Enter V_1 on the takeoff data card.

A. TAKEOFF GROSS WEIGHT DATA (Cont'd)

(5) If the Nose Brake is inoperative reduce V_1 obtained in preceding paragraph by 3 knots but DO NOT REDUCE BELOW V_{mcg}.

d. Takeoff restrictions in slush, wet snow or standing water.

(1) Takeoffs will not be made on runways on which more than 1/2 inch slush, standing water or wet snow is present.

(2) To account for deterioration in performance when 1/2 inch or less is present, reduce the runway limit weight by the slush maximum weight percentage on the bottom of the takeoff chart.

NOTE

This restriction is intended to apply only when the runway is generally covered by water, slush, or wet snow and does not imply that the depth of isolated puddles is a limitation. However, particular attention must be given the lift-off end of the runway where the effects on acceleration are the most severe.

General Managers of Flying and Station Operations and Dispatchers are alert to these limitations and are responsible to keep pilots informed on pertinent field conditions. However, the captain must exercise his good judgement in determining the applicability of this policy prior to takeoff.

B. V_2 AND BOUNDARY SPEED PLACARD

V_2 MIN SPEEDS USE LARGER VALUE V_2 MIN OR 1.1 V_{MCA}		BOUNDARY SPEEDS (880)	
WEIGHT	IAS	WEIGHT	IAS
185000	163	184500	168
180000	161	180000	166
170000	157	170000	162
160000	152	160000	157
150000	148	150000	152
140000	143*	140000	148
130000	138*	130000	142
120000	133*	120000	137
110000	127*	110000	131
100000	122*	100000	126

*CHECK RUNWAY GROSS WT CHART FOR V_{MCA}

(1-73473-1)

* * *

TAKEOFF SAMPLE CHART

ORD 14R   CV-880 CJ-805-3A   20 DEG FLAPS
LENGTH 11600.   ELEV 667.
RUNWAY LIMITED   GRAD -0.11

14R

G/W	V1	V2	VR INCREMENT TEMP-F 20	50	80	110
185	149	163	14	14	12	9
180	147	161	15	15	13	10
170	142	157	17	17	15	12
160	137	152	19	19	17	14
150	130	148	22	22	20	17
140	123	143	23	22	22	19
130	116	138	23	22	21	22
120	109	133	23	22	21	20
VMCG			132	132	129	126
V2 MIN			147	145	141	136

GROSS WEIGHT CORRECTIONS

BARO PRESS- FOR EACH .1 IN HG BELOW 29.70 USE 1 DEG HOTTER TEMP.

WIND-ADJUST ZERO WIND COLUMN
ADD 360 LBS/KT EFF H W
SUB 1160 LBS/KT EFF T W
ADJUST TIRE LIMIT COLUMN
ADD 800 LBS/KT ACT H W
SUB 2300 LBS/KT ACT T W
DO NOT EXCEED STRUCT/CLIMB WT

SPEED CORRECTIONS
REDUCE V1 1 KT/1000 LB ACTUAL WGT IS BELOW R W LIMIT WT BUT NOT LESS THAN VMCG.
FOR V2 USE GREATER OF V2 FOR TAKEOFF WEIGHT OR V2 MIN FOR AMBIENT TEMPERATURE.
FOR NWBI REDUCE V1 BY 3 KTS.

TEMP DEG F	ZERO WIND	STRUCT /CLIMB LIMIT	TIRE LIMIT
-10	1995*	1845	2145*
0	1995*	1845	2137*
10	1995*	1845	2128*
20	1995*	1845	2115*
30	1995*	1845	2092*
32	1995*	1845	2085*
34	1995*	1845	2079*
36	1995*	1845	2072*
38	1995*	1845	2066*
40	1995*	1845	2060*
42	1995*	1845	2054*
44	1995*	1845	2048*
46	1995*	1845	2043*
48	1995*	1845	2037*
50	1995*	1845	2031*
52	1995*	1845	2026*
54	1995*	1845	2020*
56	1995*	1845	2015*
58	1995*	1845	2009*
60	1995*	1845	2004*
62	1994*	1845	1995*
64	1993*	1845	1987*
66	1992*	1845	1979*
68	1991*	1845	1970*
70	1990*	1845	1962*
72	1982*	1845	1954*
74	1974*	1845	1946*
76	1966*	1845	1938*
78	1958*	1845	1929*
80	1950*	1845	1921*
82	1941*	1845	1913*
84	1933*	1845	1905*
86	1925*	1845	1897*
88	1917*	1845	1889*
90	1909*	1845	1881*
92	1900*	1845	1873*
94	1892*	1845	1865*
96	1884*	1845	1857*
98	1875*	1845	1849*
100	1867*	1845	1841
110	1822	1845	1803
120	1772*	1771	1764

SLUSH MAX WT-REDUCE R W LIMIT WT BY 5 PERCENT.

* MORE THAN PERMITTED BY STRUCT/CLIMB LIMIT COLUMN. USE FOR TAILWIND, SLUSH AND V_1 ADJUSTMENT.

* * *

A. AIRPORT LANDING GROSS WEIGHT DATA

1. Tabulated landing gross weight data is provided for dry runway dispatch, wet runway dispatch, landing at less than 3/4 (4000 RVR) visibility, and dry runway nose brake inoperative. The weights shown in the Max Weight, Zero Wind column may be in excess of the maximum certificated landing weight. The weights are shown in this manner to provide landing performance guidance should an emergency situation dictate an overweight landing. For normal operations, landings must not be planned at weights exceeding maximum certificated landing weight.

a. The Dry Dispatch column is based on stopping within 60% of the runway length without using reverse thrust and contains all the data necessary to determine runway limited landing weights for normal operations. It includes the Max Weight Zero Wind gross weights and the headwind and tailwind accountability factors used to adjust the zero wind weight for the actual wind. The maximum landing weight must be the lesser of this adjusted runway limit weight and the maximum certificated landing gross weight shown in the note at the bottom of the chart.

b. The Wet Dispatch or Less Than 3/4 or 4000 RVR column contains the same type of performance data as the Dry, and is applicable only when dispatching to a runway forcast to be wet, or when arriving with less than 3/4 (4000 RVR) visibility.

(1) The limitations of the Wet Dispatch section apply only at the time of dispatch and provide for the planned 15% additional runway length required if the destination airport is forecast to be wet for the flight arrival. Forecast of a wet or slippery runway is defined as:

(a) Precipitation heavier than light when the temperature is 26°F or higher.

(b) If the forecast calls for precipitation to end, the runway shall be considered to be wet or slippery for at least 30 minutes after the end of the forecast.

(c) Where probability of precipitation is forecast, whether continuous or intermittent, 50% or greater is considered wet.

The wet runway regulation does not apply to an airport used as an alternate.

(2) Landing with less than 3/4 or 4000 RVR visibility requires 15% additional runway over FAR field length. It is a limitation only at the time of initiating the approach.

c. The Nose Brake Inoperative column contains the same type of performance data as above for a dry runway. The maximum certificated weight NBI is 146,600 lbs. Dispatching with Nose Brake inoperative is not permitted if the runway is forecast to be wet

d. Airport Temperature Limits

(1) The airport critical temperature is the hottest temperature that all approach and landing climb limits can be met at maximum certificated landing gross weight for all altitudes up to 5700'. Above 5700' maximum ldg. weight is reduced to 153,000 lbs. and the critical temperature is based on this value.

(2) The Pounds per °F Above Crit Temp factor allows the certificated landing weight to be adjusted for the loss in performance above critical temperature.

(3) The maximum airport operating temperature (MOT) is a limitation established in certification. Dispatch to a destination forecasting a temperature in excess of MOT is not permitted; however, landing is permitted if the actual temperature on arrival exceeds MOT.

2. Normal Procedures
To determine the maximum allowable landing weight select the desired airport, runway, and landing category; and read the maximum weight zero wind.

a. If zero wind weight is less than maximum certificated landing weight, and a headwind component exists, the landing weight may be increased by the actual headwind value in knots times the Add Lbs/Kt. HW value.

b. If a tailwind exists, reduce the maximum weight zero wind by the actual tailwind in knots times the Sub Lbs/Kt. TW value. Do not exceed the additional tailwind limitations shown below.

Runways clean and dry:
No tailwind is permitted on runways shorter than 6000'.
10 Kts tailwind is permitted on runways of 6000' and longer.

Runways NOT clean and dry:
No tailwind is permitted on runways shorter than 6900'.
5 Kts tailwind is permitted on runways of 6900' to 7500' provided the total surface wind is 10 Kts or less.
10 Kts tailwind is permitted on runways of 7500' and longer.

c. When gusts are reported, the steady wind component is the controlling factor for tailwind limitations. Peak gust component is the controlling factor for crosswind limitations.

d. Airport limiting weight for approach and landing climb capability: If the forecast temperature is in excess of the airport critical temperature but below maximum operating temperature, subtract the product of the excess temperature and the Sub Lb/°F from the maximum certificated landing gross weight. (See A-1-d-(1) for altitude above 5700 feet).

e. The maximum landing gross weight is the lesser of the gross weights calculated above.

3. Slush
To avoid damage to the aircraft, landing shall not be made in standing water, slush, or wet snow in excess of 1" depth. This depth limitation is intended for general conditions of the runway and not isolated puddles. However, particular attention should be given to the approach end of the runway in evaluation of this condition.

A. AIRPORT LANDING GROSS WEIGHT DATA (Cont'd)

4. Overweight Landings
In the event that some emergency exists necessitating a flight return or an unscheduled landing en route, use the following guidelines to determine the need for fuel dumping.

a. All Engines Operating

(1) SCD - Fuel should not be dumped provided the landing gross weight charts indicate sufficient runway length is available for the overweight landing. The maximum landing weight is determined in the normal manner except the weight may exceed the maximum certificated landing weight and critical temperature adjustment is not necessary.

(2) If the landing gross weight chart indicates that insufficient runway length is available, the weight should be reduced by dumping fuel to the maximum allowable for the intended runway as determined above.

b. One Engine Inoperative
Fuel should be dumped to the landing weight at which both the landing field length requirements previously determined and engine out climb performance limitations can be met. To determine the maximum engine out landing weight enter the Engine Out Maximum Landing Gross Weight Chart with the airport temperature, proceed to the airport altitude and to the left to the engine out maximum landing weight. Make applicable anti-ice corrections indicated in the note box. The landing weight must be the lesser of these two weights.

c. If a headwind factor is published, the landing gross weight may be increased only to maximum certificated landing gross weight.

d. When a landing is made over the maximum certificated landing weight, note in the logbook that an overweight landing was made and indicate whether the landing was "normal" or "hard". An abbreviated overweight landing inspection will be conducted for a normal landing.

B. ENGINE OUT MAXIMUM LANDING GROSS WEIGHT

ALTITUDE — 1000 FT.

TEMPERATURE - °F	SL	500	1000	1500	2000	2500	3000	4000	5000	6000
35	183.0	183.0	183.0	183.0	183.0	180.0	177.0	170.0	164.0	157.5
40				180.5	178.0	175.0	172.0	165.5	159.5	153.0
45										
50										
55										
60									159.5	
62				180.5	178.0	175.0	172.0	165.5	159.0	153.0
64			183.0	180.0	177.5	174.5	171.5	165.0	159.0	153.0
66		183.0	182.5	179.5	177.0	174.0	171.0	165.0	159.0	152.5
68		182.5	182.0	179.0	176.5	173.5	170.5	164.5	158.5	152.0
70		182.5	181.5	178.5	176.0	173.0	170.0	164.0	158.0	152.0
72		182.0	180.5	177.5	175.0	172.0	169.5	163.5	157.5	151.5
74		181.5	180.0	176.5	174.5	171.5	169.0	163.0	157.0	151.0
76		181.0	179.0	176.0	173.5	170.5	168.0	162.5	156.5	150.5
78		180.5	178.0	175.5	173.0	170.0	167.5	162.0	156.0	150.0
80	183.0	180.0	177.5	174.5	172.0	169.0	166.5	161.0	155.5	149.5
82	182.0	179.0	176.5	173.5	171.0	168.0	165.5	160.0	154.5	148.5
84	181.0	178.0	175.5	172.5	170.0	167.0	164.5	159.5	153.5	147.5
86	180.0	177.0	174.5	171.5	169.0	166.0	163.5	158.5	152.5	146.5
88	179.5	176.0	173.5	171.0	168.5	165.5	162.5	157.5	151.5	146.0
90	178.5	175.0	172.5	170.0	167.5	164.5	162.0	156.5	150.5	145.0
92	177.5	174.0	171.5	169.0	166.5	163.5	161.0	155.5	150.0	144.0
94	176.5	174.0	171.0	168.0	165.5	162.5	160.0	154.5	149.0	143.0
96	175.5	173.0	170.0	167.0	164.5	161.5	159.0	153.5	148.0	142.0
98	174.5	172.0	169.0	166.0	163.5	160.5	158.0	153.0	147.0	141.0
100	173.5	171.0	168.0	165.0	162.5	159.5	157.0	152.0	146.0	140.0
102	172.5	170.0	167.0	164.0	161.5	158.5	156.0	151.0	145.0	139.0
104	172.0	169.0	166.0	163.5	161.0	158.0	155.5	150.0	144.5	138.5
106	171.0	168.0	165.0	162.5	160.0	157.0	154.5	149.0	143.5	137.5
108	170.0	167.0	164.0	161.5	159.0	156.0	153.5	148.0	142.5	136.5
110	169.0	166.0	163.0	160.5	158.0	155.0	152.5	147.0	141.5	
112	168.0	165.0	162.5	159.5	157.0	154.0	151.5	146.5	140.5	
114	167.0	164.0	161.5	158.5	156.5	153.5	150.5	145.5		
116	166.0	163.0	160.5	158.0	155.5	152.5	149.5			
118	165.0	162.0	159.5	157.0	154.5	151.5	148.5			
120	164.0	161.0	158.5	156.0	153.5	150.5				

Example: If the temperature is 84°F and the field elevation is 3000 ft. the aircraft would have to weigh less than 164,500 lbs. to meet the engine out maximum landing gross weight.

Note: Reduce above weights 11,000 lbs. when operating or planning to operate any part of the flight in icing conditions AND the forecast landing temperatures are below 40°F.

NOTE: LANDING GROSS WEIGHT MUST NOT EXCEED RUNWAY LIMITED WEIGHTS ON LANDING CHARTS

* * *

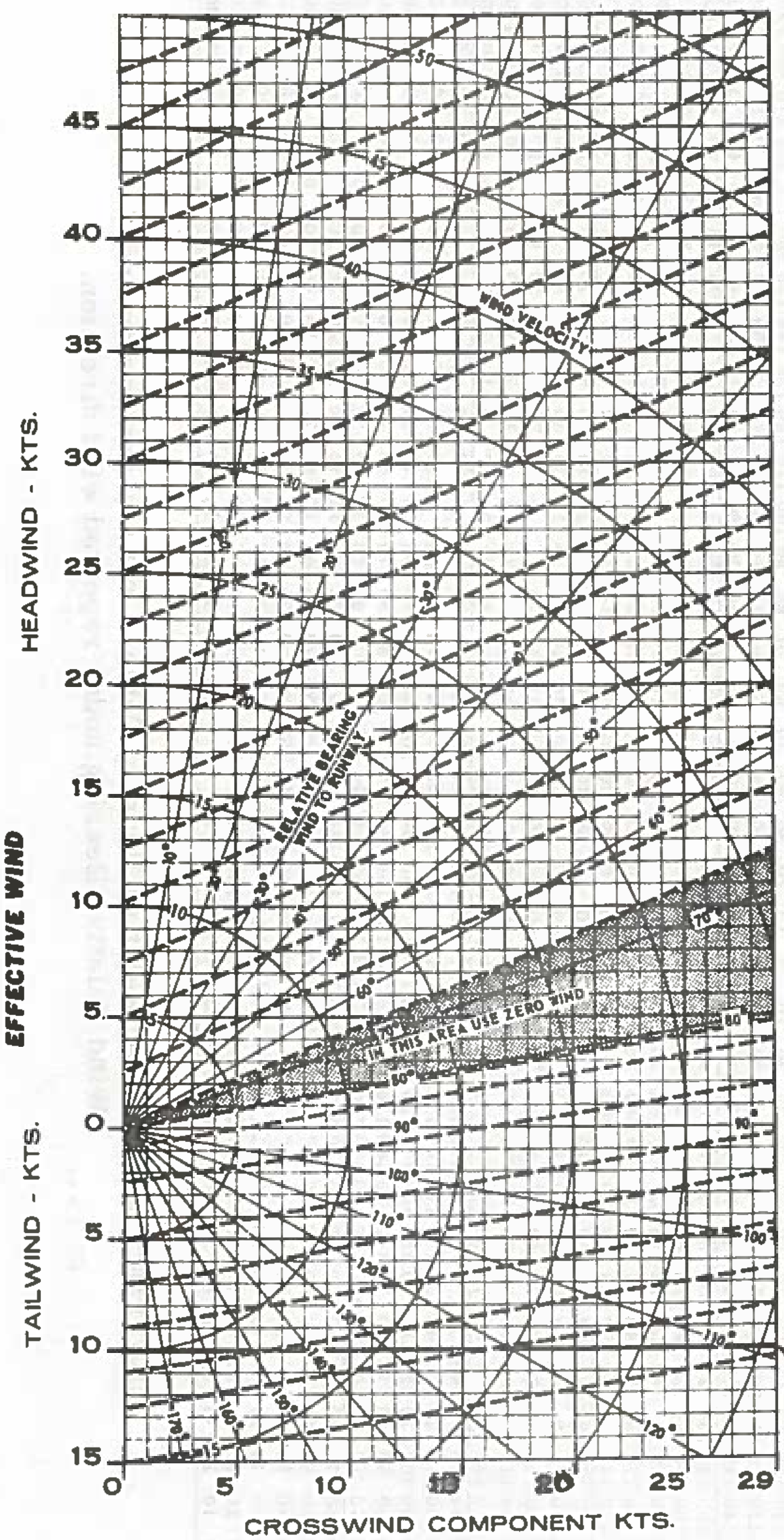
A. RELATIVE BEARING - WIND TO RUNWAY

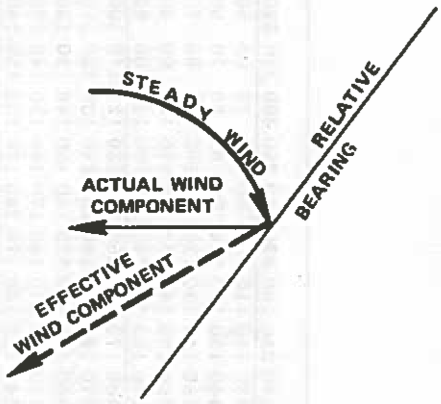
WIND DIRECTION - DEGREES MAGNETIC

Rwy No.	360	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350
1	10	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20
2	20	10	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30
3	30	20	10	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40
4	40	30	20	10	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	170	160	150	140	130	120	110	100	90	80	70	60	50
5	50	40	30	20	10	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	170	160	150	140	130	120	110	100	90	80	70	60
6	60	50	40	30	20	10	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	170	160	150	140	130	120	110	100	90	80	70
7	70	60	50	40	30	20	10	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	170	160	150	140	130	120	110	100	90	80
8	80	70	60	50	40	30	20	10	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	170	160	150	140	130	120	110	100	90
9	90	80	70	60	50	40	30	20	10	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	170	160	150	140	130	120	110	100
10	100	90	80	70	60	50	40	30	20	10	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	170	160	150	140	130	120	110
11	110	100	90	80	70	60	50	40	30	20	10	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	170	160	150	140	130	120
12	120	110	100	90	80	70	60	50	40	30	20	10	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	170	160	150	140	130
13	130	120	110	100	90	80	70	60	50	40	30	20	10	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	170	160	150	140
14	140	130	120	110	100	90	80	70	60	50	40	30	20	10	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	170	160	150
15	150	140	130	120	110	100	90	80	70	60	50	40	30	20	10	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	170	160
16	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	10	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	170
17	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	10	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
18	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	10	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170
19	170	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	10	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160
20	160	170	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	10	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150
21	150	160	170	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	10	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140
22	140	150	160	170	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	10	0	10	20	30	40	50	60	70	80	90	100	110	120	130
23	130	140	150	160	170	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	10	0	10	20	30	40	50	60	70	80	90	100	110	120
24	120	130	140	150	160	170	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	10	0	10	20	30	40	50	60	70	80	90	100	110
25	110	120	130	140	150	160	170	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	10	0	10	20	30	40	50	60	70	80	90	100
26	100	110	120	130	140	150	160	170	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	10	0	10	20	30	40	50	60	70	80	90
27	90	100	110	120	130	140	150	160	170	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	10	0	10	20	30	40	50	60	70	80
28	80	90	100	110	120	130	140	150	160	170	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	10	0	10	20	30	40	50	60	70
29	70	80	90	100	110	120	130	140	150	160	170	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	10	0	10	20	30	40	50	60
30	60	70	80	90	100	110	120	130	140	150	160	170	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	10	0	10	20	30	40	50
31	50	60	70	80	90	100	110	120	130	140	150	160	170	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	10	0	10	20	30	40
32	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	10	0	10	20	30
33	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	10	0	10	20
34	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	10	0	10
35	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	10	0
36	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	10

INSTRUCTIONS: Enter Relative Bearing Table at runway number and read Wind Relative Bearing under reported wind direction.

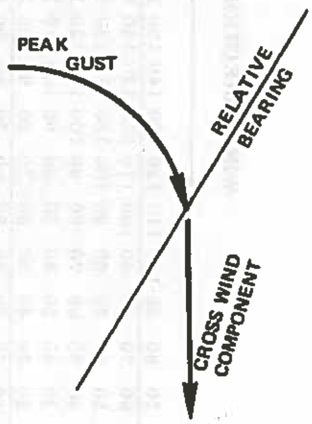
EFFECTIVE AND ACTUAL WIND COMPONENT CHART





ENTER WITH STEADY WIND.
PROCEED TO THE RELATIVE BEARING LINE AND READ THE ACTUAL AND EFFECTIVE WIND COMPONENT.
THE EFFECTIVE WIND COMPONENT COMPENSATES FOR CROSSWIND-DRAG.

ENTER WITH PEAK GUST TO FIND CROSS-WIND COMPONENT.



JET AIRCRAFT
AIRPORT LANDING GROSS WEIGHT DATA

AIRPORT				DRY Dsp.			WET Dsp or Arrival Below ¾ or 4000 RVR			NOSE BRAKE – INOP DRY			APT TEMP LIMITS Missed APP		
STATION	MODEL	RUNWAY NUMBER	RUNWAY LENGTH	MAX WEIGHT ZERO WIND	ADD LB/KT ACTUAL H.W.	SUB LB/KT ACTUAL T.W.	MAX WEIGHT ZERO WIND	ADD LB/KT ACTUAL H.W.	SUB LB/KT ACTUAL T.W.	MAX WEIGHT ZERO WIND	ADD LB/KT ACTUAL H.W.	SUB LB/KT ACTUAL T.W.	APT CRIT TEMP	*SUB LB/°F ABOVE CRIT TEMP	MAX APT OPR TEMP
ALBUQUERQUE, NEW MEXICO	CV-880	3 -D 21	6717	126500	500	1340	N.A.			117000	480	1430	74	450	109
SUNPORT / KIRTLAND AFB		8	12774	200000	0	1980	200000	0	2030	200000	0	2150			
ALT. 5352 FT		17	8993	173300	0	1640	149200	520	1520	160300	0	1790			
N NIGHT USE ONLY		N 21	6407	120300	490	1280	N.A.								
D DAY USE ONLY		26	13373	200000	0	1380	200000	0	2040	200000	0	2150			
		35	8993	167500	0	1620	144200	510	1490	154900	0	1740			
AMARILLO, TEXAS	CV-880	3 - 21	13500	200000	0	1950	200000	0	2120	200000	0	2250	98	550	117
AMARILLO AFB / MUN.															
ALT. 3605 FT															
ATLANTA, GA	CV-880	3	6937	147400	570	1590	126600	550	1510	136200	560	1710	120	0	120
ATLANTA APT.		8 - 26	10000	200000	0	1970	188800	0	1850	200000	0	2180			
ALT. 1024 FT		9L- 27R	8000	172400	0	1770	147900	570	1590	159000	0	1870			
		9R- 27L	9000	195800	0	1870	168300	0	1750	181300	0	2060			
		15	7400	158200	0	1560	136000	540	1560	146000	590	1770			
		21	5506	N.A.											
		33	9067	197400	0	1980	169700	0	1760	182700	0	2070			
BALTIMORE, MD.	CV-880	4 - 22	6000	124800	560	1540	N.A.			119100	540	1660	120	0	120
FRIENDSHIP INT'L.		10 - 28	9450	200000	0	1920	182100	0	1850	195400	0	2100			
ALT. 146 FT		15 - 33	9500	200000	0	1930	183100	0	1850	195500	0	2100			
BANGOR, MAINE	CV-880	15 - 33	11439	200000	0	1980	200000	0	2140	200000	0	2250	120	0	120
BANGOR APT.															
ALT. 192 FT															
BEDFORD, MASS.	CV-880	11 - 29	7000	152600	590	1560	130900	560	1550	141000	580	1780	120	0	120
HANSCOM FIELD															
ALT. 133 FT															
BIRMINGHAM, ALA.	CV-880	5	10000	200000	0	1970	190700	0	1850	200000	0	2170	120	0	120
BIRMINGHAM MUN APT.		23	8230	179800	0	1820	154100	590	1640	165800	0	1940			
ALT. 643 FT															
BOSTON, MASS.	CV-880	4L	7870	174400	0	1820	149300	590	1650	160800	0	1910	120	0	120
LOGAN INT'L APT. >		Y 4R	9500	200000	0	1930	183800	0	1960	197100	0	2090			
ALT. 19 FT		Z 4R	7493	165100	0	1760	141500	580	1610	152300	0	1840			
Z NIGHT OR IFR DUE TO		9 - 27	7021	153600	600	1580	131700	560	1560	141900	580	1790			
DISPLACED THRESHOLD		15R	9190	200000	0	1890	177400	0	1840	190300	0	2070			
Y DAY VFR ONLY		22L	10000	200000	0	1970	193900	0	1850	200000	0	2160			
		22R	7042	154100	600	1580	132200	560	1560	142300	590	1790			
		33L	10080	200000	0	1970	195500	0	1850	200000	0	2170			
BURLINGTON, VT.	CV-880	15	7807	171200	0	1790	146800	580	1620	157900	0	1880	120	0	120
BURLINGTON MUN APT.		33	7807	169300	0	1780	145100	570	1620	156100	0	1860			
ALT. 335 FT															

NOTE: PLANNED LDG. WT. MUST NOT EXCEED THE FOLLOWING MAXIMUM CERTIFICATED LDG. WT.

NOSE BK – ON	NOSE BK – INOP
155,000	146,600

* SUB. FROM CERTIFICATED LDG. WT.
> DENOTES NEW DATA
N.A. NOT AUTHORIZED
FOR ADDITIONAL T.W. RESTRICTIONS SEE LDG. INST. IN F.H.B.

TRANS WORLD AIRLINES

JET AIRCRAFT
AIRPORT LANDING GROSS WEIGHT DATA

880

AIRPORT				DRY Dsp.			Below ¾ or 4000 RVR			DRY			Missed APP		
STATION	MODEL	RUNWAY NUMBER	RUNWAY LENGTH	MAX WEIGHT ZERO WIND	ADD LB/KT ACTUAL H W	SUB LB/KT ACTUAL T W	MAX WEIGHT ZERO WIND	ADD LB/KT ACTUAL H W	SUB LB/KT ACTUAL T W	MAX WEIGHT ZERO WIND	ADD LB/KT ACTUAL H W	SUB LB/KT ACTUAL T W	APT CRIT TEMP	* SUB LB/°F ABOVE CRIT TEMP	MAX APT OPR TEMP
CASPER, WYOMING	CV-880	3 - 21	8672	166700	0	1610	143500	510	1490	154100	0	1740	74	450	110
NATRONA CO. INT'L APT.		7 - 25	8681	166900	0	1610	143600	510	1490	154300	0	1740			
ALT. 5348 FT.		12	8687	167000	0	1610	143700	510	1490	154400	0	1740			
		16 - 34	9061	174700	0	1650	150400	520	1520	161700	0	1800			
		30	8687	165000	0	1600	142000	510	1480	152400	0	1730			
CHARLESTON, S.C.	CV-880	3 - 21	7000	153000	600	1670	131200	560	1560	141300	580	1780	120	0	120
CHARLESTON AFB/MUN APT.		15 - 33	9000	200000	0	1860	173200	0	1820	186000	0	2070			
ALT. 45 FT.															
CHEYENNE, WYOMING	CV-880	8	8600	161300	0	1550	138900	500	1440	149200	0	1700	60	410	105
CHEYENNE MUNICIPAL APT.		12	6293	115500	460	1220	N.A.								
ALT. 6156 FT.		26	9201	173200	0	1610	149300	510	1490	160600	0	1770			
		30	6691	123200	480	1290	N.A.			114000	460	1380			
CHICAGO, ILLINOIS	CV-880	4L- 22R	7500	162200	0	1700	139300	550	1580	149600	0	1800	120	0	120
O'HARE INTERNATIONAL APT>		4R	5872	118600	550	N.A.	N.A.								
ALT. 667 FT.		9L- 27R	7416	160200	0	1690	137600	550	1580	147800	0	1790			
		9R- 27L	10140	200000	0	1970	193400	0	1860	200000	0	2190			
		14L- 32R	10003	200000	0	1970	190600	0	1850	200000	0	2170			
		14R- 32L	11600	200000	0	1980	200000	0	2150	200000	0	2270			
>		22L	8072	175900	0	1810	150800	580	1620	162200	0	1900			
CINCINNATI, OHIO	CV-880	9R- 27L	7800	168300	0	1750	144500	560	1590	155200	0	1840	120	0	120
GREATER CINCINNATI APT.		18 - 36	9501	200000	0	1920	179300	0	1810	193000	0	2130			
ALT. 890 FT															
CLEVELAND, OHIO	CV-880	5L- 23R	6242	132400	550	1550	N.A.			122300	530	1650	120	0	120
HOPKINS INTERNATIONAL		5R- 23L	9000	197000	0	1870	169400	0	1760	182400	0	2070			
ALT. 792 FT.		10L	6014	121900	550	1490	N.A.								
		18R- 36L	6411	136300	550	1570	116800	540	N.A.	125900	540	1670			
		28R	6014	127000	550	1510	N.A.			117400	520	1620			
COLORADO SPRINGS, COLO.	CV-880	3	8374	156700	0	1530	135000	490	1420	144900	550	1660	60	400	105
PETERSON FIELD		12 - 30	8511	159400	0	1540	137300	490	1440	147500	0	1680			
ALT. 6172 FT		17 - 35	11013	200000	0	1790	180600	0	1650	194800	0	1960			
		21	7854	146300	500	1480	126000	490	1330	135100	530	1580			
COLOMBUS, OHIO	CV-880	10L- 28R	6000	126600	550	1510	N.A.			117000	530	1620	120	0	120
PORT COLOMBUS INT'L APT.		10R- 28L	10700	200000	0	1980	200000	0	2060	200000	0	2260			
ALT. 816 FT.															
DAYTON, OHIO	CV-880	6L- 24R	9500	200000	0	1910	178600	0	1810	192400	0	2130	120	0	120
COX DAYTON MUN. AIRPORT		6R- 24L	7000	148900	570	1590	128000	550	1520	137600	560	1720			
ALT. 1008 FT.		18 - 36	7000	148900	570	1590	128000	550	1520	137600	560	1720			
DENVER, COLORADO	CV-880	8R- 26L	10010	194300	0	1750	167500	0	1620	180300	0	1920	74	450	110
STAPLETON INTERNATIONAL		17 - 35	11500	200000	0	1870	194100	0	1750	200000	0	2080			
ALT. 5330 FT.															

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155,000	146,600

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JET AIRCRAFT
AIRPORT LANDING GROSS WEIGHT DATA

880

AIRPORT				DRY Dsp.			WET Dsp or Arrival Below ¾ or 4000 RVR			NOSE BRAKE – INOP DRY			APT TEMP LIMITS Missed APP		
STATION	MODEL	RUNWAY NUMBER	RUNWAY LENGTH	MAX WEIGHT ZERO WIND	ADD LB/KT ACTUAL H.W.	SUB LB/KT ACTUAL T.W.	MAX WEIGHT ZERO WIND	ADD LB/KT ACTUAL H.W.	SUB LB/KT ACTUAL T.W.	MAX WEIGHT ZERO WIND	ADD LB/KT ACTUAL H.W.	SUB LB/KT ACTUAL T.W.	APT CRIT TEMP	✱SUB LB/°F ABOVE CRIT TEMP	MAX APT OPR TEMP
DES MOINES, IOWA DES MOINES MUN APT. ALT. 957 FT	CV-880	5 - 23 12L- 30R	6500 9000	137800 196200	550 0	1570 1870	118300 168600	540 0	N.A. 1750	127100 181600	550 0	1660 2060	123	[illegible]	120
DETROIT, MICH. METRO WAYNE CO. APT. ALT. 639 FT	CV-880	3L- 21R 3R- 21L 9 - 27	10500 8500 8703	200000 186100 190900	0 0 0	1970 1830 1850	200000 159700 163900	0 0 0	2040 1680 1720	200000 171900 176400	0 0 0	2230 1980 2020	120	0	120
FRESNO, CALIF. FRESNO AIR TERMINAL ALT. 332 FT	CV-880	11L- 29R	9218	200000	0	1900	176300	0	1820	189400	0	2090	120	0	120
GRAND ISLAND, NEBR. GRAND ISLAND APT. ALT. 1846 FT	CV-880	4 - 22 13 - 31 17 - 35	7189 7102 7001	149900 147900 145600	570 560 560	1580 1560 1550	129300 127300 125200	530 530 530	1510 1500 1490	138500 136700 134600	560 550 550	1700 1690 1680	117	540	120
INDIANAPOLIS, IND. WEIR COOK APT. ALT. 797 FT	CV-880	4L- 22R 13R- 31L	10004 7604	200000 164100	0 0	1970 1720	190000 140900	0 550	1850 1590	200000 151400	0 0	2170 1810	120	0	120
JACKSONVILLE, FLA. JACKSONVILLE INTL. APT. ALT. 29 FT	CV-880	7 - 25 13 - 31	8000 7701	177500 170200	0 0	1840 1800	152000 145800	590 580	1670 1630	163700 156900	0 0	1940 1880	120	0	120
KANSAS CITY, MO. KANSAS CITY INT'L APT. ALT. 1025 FT	CV-880	1 - 19 9 - 27	10801 9500	200000 200000	0 0	1980 1910	200000 178600	0 0	2060 1810	200000 192300	0 0	2280 2130	120	0	120
KANSAS CITY, MO. KANSAS CITY MUN. APT. ALT. 758 FT	CV-880	18 36	7000 7000	144900 150000	560 580	1600 1610	124400 128800	550 550	1510 1530	133900 138600	560 570	1710 1730	120	0	120
KNOXVILLE, TENN. MC GHEE TYSON APT. ALT. 981 FT	CV-880	4L- 22R	9000	196000	0	1870	168500	0	1750	181500	0	2060	120	0	120
LAS VEGAS, NEVADA MC CARRAN FIELD ALT. 2171 FT	CV-980	1R 7 19L 25	6869 11781 7500 12545	141500 200000 155600 200000	540 0 0 0	1530 1990 1620 1990	121600 200000 133900 200000	530 0 530 0	N.A. 2150 1510 2160	130700 200000 143600 200000	540 0 570 0	1650 2330 1720 2330	113	550	120
LAS VEGAS, NEVADA NELLIS AFB ALT. 1868 FT	CV-880	3L- 21R 3R- 21L	10120 10050	200000 200000	0 0	1970 1960	186900 185500	0 0	1820 1820	200000 200000	0 0	2210 2200	117	540	120
LONG BEACH, CALF. LONG BEACH MUN APT. ALT. 53 FT	CV-880	12 25R 30	8650 5661 10000	192600 115600 200000	0 550 0	1850 N.A. 1970	165600 N.A. 193700	0 0	1760 1850	178300 200000	0 0	2050 2160	120	0	120

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TRANS WORLD AIRLINES

JET AIRCRAFT

AIRPORT LANDING GROSS WEIGHT DATA

880

				[illegible]			Below ¾ or 4000 RVR			DRY			Missed APP		
STATION	MODEL	RUNWAY NUMBER	RUNWAY LENGTH	MAX WEIGHT ZERO WIND	ADD LB/KT ACTUAL H.W.	SUB LB/KT ACTUAL T.W.	MAX WEIGHT ZERO WIND	ADD LB/KT ACTUAL H.W.	SUB LB/KT ACTUAL T.W.	MAX WEIGHT ZERO WIND	ADD LB/KT ACTUAL H.W.	SUB LB/KT ACTUAL T.W.	APT CRIT TEMP	*SUB LB/°F ABOVE CRIT TEMP	MAX APT OPR TEMP
LOS ANGELES, CALIFORNIA	CV-880	6L- 24R	8924	198700	0	1860	171200	0	1800	163900	0	2070	120	0	120
LOS ANGELES INT'L APT.		6R	9953	200000	0	1970	192400	0	1650	200000	0	2150			
ALT. 126 FT.		7L	12090	200000	0	1980	200000	0	2140	200000	0	2250			
		7R	12000	200000	0	1980	200000	0	2140	200000	0	2250			
		24L	10284	200000	0	1970	199100	0	1970	200000	0	2190			
		25L	11395	200000	0	1980	200000	0	2140	200000	0	2250			
		25R	11490	200000	0	1980	200000	0	2140	200000	0	2250			
LOUISVILLE, KENTUCKY	CV-880	1 - 19	7800	170200	0	1780	146000	570	1610	157000	0	1860	120	0	120
STANDIFORD FIELD		11 - 29	7250	157000	0	1670	134900	550	1570	144900	590	1780			
ALT. 497 FT.															
MADISON, WISCONSIN >	CV-880	4	5532	N.A.									120	0	120
TRUAX FIELD >		18 - 36	7606	163800	0	1710	140700	550	1580	151100	0	1810			
ALT. 585 FT.															
MEMPHIS, TENNESSEE	CV-880	9 - 27	8926	197700	0	1860	170200	0	1780	183000	0	2060	120	0	120
MEMPHIS INTERNATIONAL		17L- 35R	8400	185400	0	1840	159130	0	1690	171200	0	1990			
ALT. 331 FT.		17R- 35L	9320	200000	0	1900	178400	0	1830	191700	0	2090			
MIAMI, FLORIDA	CV-880	9L- 27R	10500	200000	0	1970	200000	0	2050	200000	0	2220	120	0	120
MIAMI INTERNATIONAL APT.		9R- 27L	9349	200000	0	1910	180800	0	1850	193800	0	2080			
ALT. 9 FT.		12 - 30	9600	200000	0	1940	185900	0	1860	199400	0	2100			
MIDDLETOWN, PENNSYLVANIA	CV-880	13 - 31	8010	176300	0	1820	151000	590	1640	162500	0	1920	120	0	120
HARRISBURG INTERNATIONAL															
ALT. 308 FT.															
MILWAUKEE, WISCONSIN	CV-880	1L	9916	200000	0	1970	188600	0	1850	200000	0	2160	120	0	120
GENERAL MITCHELL FIELD		7R	8011	174200	0	1790	149300	580	1610	160600	0	1890			
ALT. 722 FT.		19R	8316	181400	0	1820	155500	0	1650	167400	0	1950			
		25L	7488	161600	0	1700	138900	550	1580	149100	0	1800			
MINNEAPOLIS, MINNESOTA	CV-880	4	8268	179700	0	1820	154100	590	1630	165700	0	1930	120	0	120
MINNEAPOLIS ST PAUL INTL		11L- 29R	8201	178100	0	1810	152700	580	1620	164300	0	1910			
ALT. 840 FT.		11R- 29L	10000	200000	0	1970	189700	0	1850	200000	0	2170			
		22	7268	155900	0	1640	134000	550	1560	144000	580	1760			
NASHVILLE, TENNESSEE	CV-880	2L- 20R	7700	167300	0	1750	143600	560	1600	154300	0	1840	120	0	120
NASHVILLE METROPOLITAN		13 - 31	8000	174600	0	1800	149600	580	1620	161000	0	1890			
ALT. 597 FT.															
NEWARK, NEW JERSEY	CV-880	4L	7475	164700	0	1760	141100	580	1610	151900	0	1840	120	0	120
NEWARK INTERNATIONAL APT		4R	8621	192100	0	1840	165200	0	1760	177800	0	2050			
ALT. 18 FT.		11	6231	134700	570	1570	115400	550	N.A.	124500	550	1690			
		22L	8211	182700	0	1860	156500	0	1700	168500	0	1980			
		22R	7775	172100	0	1810	147400	590	1640	158600	0	1890			
		29	6490	140900	570	1600	120800	550	N.A.	130200	560	1720			

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TRANS WORLD AIRLINES

JET AIRCRAFT
AIRPORT LANDING GROSS WEIGHT DATA

AIRPORT				DRY Dsp.			WET Dsp or Arrival Below ¾ or 4000 RVR			NOSE BRAKE – INOP DRY			APT TEMP LIMITS Missed APP		
STATION	MODEL	RUNWAY NUMBER	RUNWAY LENGTH	MAX WEIGHT ZERO WIND	ADD LB/KT ACTUAL H.W.	SUB LB/KT ACTUAL T.W.	MAX WEIGHT ZERO WIND	ADD LB/KT ACTUAL H.W.	SUB LB/KT ACTUAL T.W.	MAX WEIGHT ZERO WIND	ADD LB/KT ACTUAL H.W.	SUB LB/KT ACTUAL T.W.	APT CRIT TEMP	*SUB LB/°F ABOVE CRIT TEMP	MAX APT OPR TEMP
NEW YORK, NEW YORK J.F. KENNEDY INT'L APT. ALT. 12 FT	CV-880	4L	11352	200000	0	1970	200000	0	2140	200000	0	2240	120	0	120
		4R - 22L	8400	187100	0	1850	160600	0	1730	172900	0	2020			
		13L	9015	200000	0	1860	173700	0	1820	186500	0	2070			
		13R	11972	200000	0	1980	200000	0	2140	200000	0	2250			
		22R	8330	185500	0	1860	159100	0	1720	171300	0	2010			
		31L	11252	200000	0	1970	200000	0	2140	200000	0	2240			
		31R	8976	200000	0	1860	172900	0	1820	185600	0	2070			
OAKLAND, CALIFORNIA METRO OAKLAND INT'L APT. ALT. 6 FT.	CV-880	9R	5990	123400	560	N.A.	N.A.						120	0	120
		11 - 29	10000	200000	0	1970	193900	0	1840	200000	0	2160			
		15	5510	N.A.											
		27L	6210	132100	560	1560	N.A.			122100	540	1680			
OKLAHOMA CITY, OKLAHOMA WILL ROGERS WORLD APT. ALT. 1294 FT.	CV-880	12 - 30	6528	137200	540	1560	117600	540	N.A.	126600	540	1650	120	0	120
		17L - 35R	9802	200000	0	1940	183400	0	1830	197800	0	2170			
		17R - 35L	9800	200000	0	1940	183400	0	1830	197700	0	2170			
OMAHA, NEBRASKA EPPLEY AIRFIELD ALT. 983 FT.	CV-880	14R	8501	184500	0	1840	158200	0	1660	170200	0	1960	120	0	120
		17 - 35	6001	126000	550	1500	N.A.			116500	520	1610			
		32L	8200	177300	0	1800	152100	580	1610	163600	0	1930			
ONTARIO, CALIFORNIA ONTARIO INTERNATIONAL ALT. 952 FT.	CV-880	7	8982	195800	0	1870	168300	0	1750	181200	0	2060	120	0	120
		25	9982	200000	0	1970	188800	0	1850	200000	0	2170			
PALMDALE, CALIFORNIA AIR FORCE PLANT #42 ALT. 2542 FT.	CV-880	4 - 22	12000	200000	0	1980	200000	0	2140	200000	0	2310	109	530	119
		7 - 25	12002	200000	0	1980	200000	0	2140	200000	0	2310			
PHILADELPHIA, PA. PHILADELPHIA INT'L APT. ALT. 14 FT	CV-880	9 - 27	9491	200000	0	1930	183700	0	1860	196900	0	2090	120	0	120
		9R - 27L	10500	200000	0	1970	200000	0	2050	200000	0	2220			
PHOENIX, ARIZONA SKY HARBOR INT'L AIRPORT ALT. 1128 FT. >	CV-880	8L - 26R	8753	189600	0	1850	162700	0	1700	175100	0	1990	120	0	120
		8R	10300	200000	0	1980	194300	0	1860	200000	0	2220			
		26L	9594	200000	0	1920	179900	0	1810	193900	0	2150			
PITTSBURGH, PENNSYLVANIA GREATER PITTSBURGH INT'L ALT. 1203 FT.	CV-880	5 - 23	5766	114500	540	N.A.	N.A.						120	0	120
		10L - 28R	10500	200000	0	1980	197900	0	1880	200000	0	2240			
		10R	10000	200000	0	1970	187900	0	1840	200000	0	2180			
		14 - 32	6700	141400	550	1580	121300	540	N.A.	130600	550	1680			
		28L	9500	200000	0	1910	177700	0	1800	191500	0	2140			
RENO, NEVADA RENO INTERNATIONAL APT. ALT. 4411 FT.	CV-880	7	5640	N.A.									88	520	114
		16 - 34	9300	178400	0	1700	153400	540	1570	164900	0	1840			
		25	6105	117300	480	1310	N.A.								

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JET AIRCRAFT
AIRPORT LANDING GROSS WEIGHT DATA

880

AIRPORT				DRY Dsp.			Below ¾ or 4000 RVR			DRY			Missed APP		
STATION	MODEL	RUNWAY NUMBER	RUNWAY LENGTH	MAX WEIGHT ZERO WIND	ADD LB/KT ACTUAL H.W.	SUB LB/KT ACTUAL T.W.	MAX WEIGHT ZERO WIND	ADD LB/KT ACTUAL H.W.	SUB LB/KT ACTUAL T.W.	MAX WEIGHT ZERO WIND	ADD LB/KT ACTUAL H.W.	SUB LB/KT ACTUAL T.W.	APT CRIT TEMP	✱SUB LB/°F ABOVE CRIT TEMP	MAX APT OPR TEMP
RICHMOND, VA.	CV-880	2 - 20	6606	143100	570	1610	122700	550	N.A.	132200	560	1730	120	0	120
BYRD FIELD		15 - 33	9000	200000	0	1870	172600	0	1810	185400	0	2070			
ALT. 167 FT															
SACRAMENTO, CALIF.	CV-880	16 - 34	8600	191600	0	1840	164800	0	1760	177300	0	2050	120	0	120
SACRAMENTO METRO APT.															
ALT. 21 FT															
ST. JOSEPH, MO.	CV-880	4 - 22	5600	N.A.									120	0	120
ROSECRANS MEML APT.		13 - 31	6000	126500	550	1510	N.A.			117000	520	1620			
ALT. 826 FT		17 - 35	8059	174800	0	1790	149900	580	1610	161200	0	1890			
ST. LOUIS, MO.	CV-880	6 - 24	7600	165000	0	1730	141700	560	1600	152200	0	1820	120	0	120
LAMBERT ST. LOUIS MUN		12L- 30R	6600	141500	560	1590	121300	550	N.A.	130600	550	1700			
ALT. 571 FT		12R	9518	200000	0	1920	181200	0	1830	194900	0	2120			
		17 - 35	6000	127400	550	1520	N.A.			117800	530	1630			
		30L	10013	200000	0	1970	191400	0	1850	200000	0	2170			
SALINA, KANSAS	CV-880	D 12 -D 30	8997	194500	0	1860	167000	0	1730	180000	0	2050	120	0	120
SALINA MUN APT.		17 - 35	13331	200000	0	2000	200000	0	2160	200000	0	2310			
ALT. 1272 FT															
D DAY USE ONLY															
SALT LAKE CITY, UTAH >	CV-880	16L	9596	192200	0	1780	165400	0	1640	177900	0	1960	91	540	114
SALT LAKE CITY MUN # 1		16R- 34L	10001	200000	0	1820	172900	0	1680	186200	0	2000			
ALT. 4226 FT >		34R	9001	179400	0	1710	154300	540	1580	165800	0	1850			
SAN FRANCISCO, CALIF.	CV-880	1L	7005	136100	570	1590	118300	550	1490	127600	560	1710	120	0	120
SAN FRANCISCO INT'L APT.		1R	8400	187100	0	1850	160600	0	1730	172900	0	2020			
ALT. 10 FT		10L	9496	200000	0	1930	183800	0	1860	197100	0	2090			
T TEMPORARY RWY LENGTH		T 10L- 28R	8900	198700	0	1850	171300	0	1810	184000	0	2070			
DUE TO WIP		10R- 28L	10580	200000	0	1970	200000	0	2060	200000	0	2230			
		19L	9500	200000	0	1930	183900	0	1860	197200	0	2090			
		19R	7005	153300	600	1680	131400	560	1560	141600	580	1790			
SAN JOSE, CALIF.	CV-880	12R	8901	198500	0	1850	171000	0	1800	183800	0	2070	120	0	120
SAN JOSE MUN APT.		30L	7425	163300	0	1740	140000	570	1600	150600	0	1830			
ALT. 56 FT															
SUMTER, S.C.	CV-880	V 4 - 22	10000	200000	0	1970	192700	0	1850	200000	0	2160	120	0	120
SHAW AFB															
ALT. 252 FT															
V VFR ONLY															
SYRACUSE, NEW YORK	CV-880	10 - 28	9005	199000	0	1870	171400	0	1790	184300	0	2070	120	0	120
HANCOCK APT.		14 - 32	6480	139200	560	1590	119300	550	N.A.	128600	550	1700			
ALT. 421 FT															

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AIRPORT LANDING GROSS WEIGHT DATA

AIRPORT				DRY Dsp.			WET Dsp or Arrival Below ¾ or 4000 RVR			NOSE BRAKE – INOP DRY			APT TEMP LIMITS Missed APP		
STATION	MODEL	RUNWAY NUMBER	RUNWAY LENGTH	MAX WEIGHT ZERO WIND	ADD LB/KT ACTUAL H W	SUB LB/KT ACTUAL T W	MAX WEIGHT ZERO WIND	ADD LB/KT ACTUAL H W	SUB LB/KT ACTUAL T W	MAX WEIGHT ZERO WIND	ADD LB/KT ACTUAL H W	SUB LB/KT ACTUAL T W	APT CRIT TEMP	*SUB LB/°F ABOVE CRIT TEMP	MAX APT OPR TEMP
TAMPA, FLORIDA	CV-880	9 - 27	7000	153100	600	1670	131300	560	1560	141400	580	1780	120	0	120
TAMPA INTERNATIONAL APT.		18L- 36R	8300	184700	0	1860	158400	0	1710	170500	0	2000			
ALT. 27 FT.		18R- 36L	8700	193900	0	1850	166900	0	1770	179500	0	2060			
TUCSON, ARIZONA	CV-880	3	6149	124000	520	1440	N.A.			114700	500	1540	108	540	119
TUCSON INTERNATIONAL APT		11L	10900	200000	0	1970	198400	0	1860	200000	0	2250			
ALT. 2630 FT.		21	6500	131700	520	1480	N.A.			121700	510	1570			
		29R	12000	200000	0	1970	200000	0	2140	200000	0	2300			
TULSA, OKLAHOMA	CV-880	8	6176	131200	550	1550	N.A.			121200	530	1650	120	0	120
TULSA INTERNATIONAL APT.		17L- 35R	10000	200000	0	1970	190500	0	1850	200000	0	2170			
ALT. 676 FT.		26	7100	152700	590	1630	131200	550	1550	141000	580	1750			
WASHINGTON, D.C.	CV-880	1L- 19R	11500	200000	0	1980	200000	0	2140	200000	0	2260	120	0	120
DULLES INTERNATIONAL APT		1R- 19L	11500	200000	0	1980	200000	0	2140	200000	0	2260			
ALT. 313 FT.		12 - 30	10000	200000	0	1970	192400	0	1850	200000	0	2160			
WICHITA, KANSAS	CV-880	1L- 19R	6999	147600	570	1570	126900	540	1510	136400	560	1700	120	0	120
WICHITA MID-CONTINENT		1R- 19L	7300	154600	580	1620	133000	540	1540	142700	580	1740			
ALT. 1332 FT.		14 - 32	6300	131900	540	1540	N.A.			121800	530	1630			
WINDSOR LOCKS, CONN.	CV-880	6 - 24	9501	200000	0	1930	183000	0	1850	196400	0	2100	120	0	120
BRADLEY INTERNATIONAL		15 - 33	6846	148800	590	1640	127600	560	N.A.	137500	570	1760			
ALT. 173 FT.															

NOTE: PLANNED LDG. WT. MUST NOT EXCEED THE FOLLOWING MAXIMUM CERTIFICATED LDG. WT.

NOSE BK – ON	NOSE BK – INOP
155,000	146,600

* SUB. FROM CERTIFICATED LDG. WT.
> DENOTES NEW DATA
N.A. NOT AUTHORIZED
FOR ADDITIONAL T.W. RESTRICTIONS SEE LDG. INST. IN F.H.B.